THE FOUNDRY

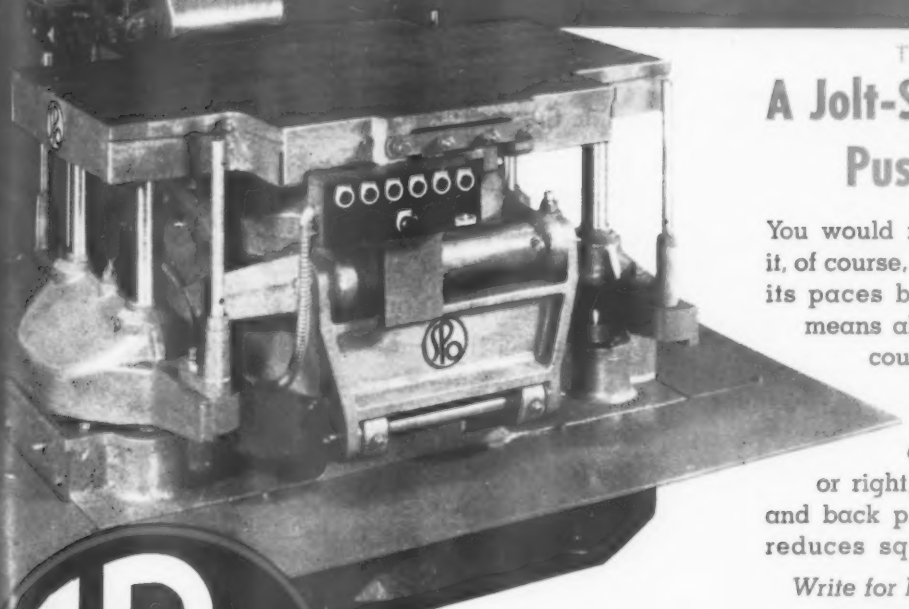
July, 1941

wherever metals are cast...

ALL MACHINE OPERATIONS ARE PERFORMED BY MEANS OF SEQUENCE-ARRANGED PUSH BUTTONS

SPO

DESIGNS and BUILDS A MOLDING MACHINE Which a Child Could Operate!



TECHNOLOGY DEPARTMENT

A Jolt-Squeeze-Strip Machine, Push-Button Operated

You would not ask a child to make molds with it, of course, but he could put the machine through its paces by the mere touch of a finger. That means about as little operator fatigue as one could expect. Jolt, squeeze and vibrator operations are timer-controlled. The power-operated squeeze head can be adjusted easily to swing left or right, and is air-locked in both forward and back positions. Husky head construction reduces squeeze board end twist or spring.

Write for bulletins on SPO Molding Machines to meet your particular requirements.

Table size 36" x 51"
Jolt capacity 2500 lbs.

Squeeze capacity 28,000 lbs.
Pattern draw 12"

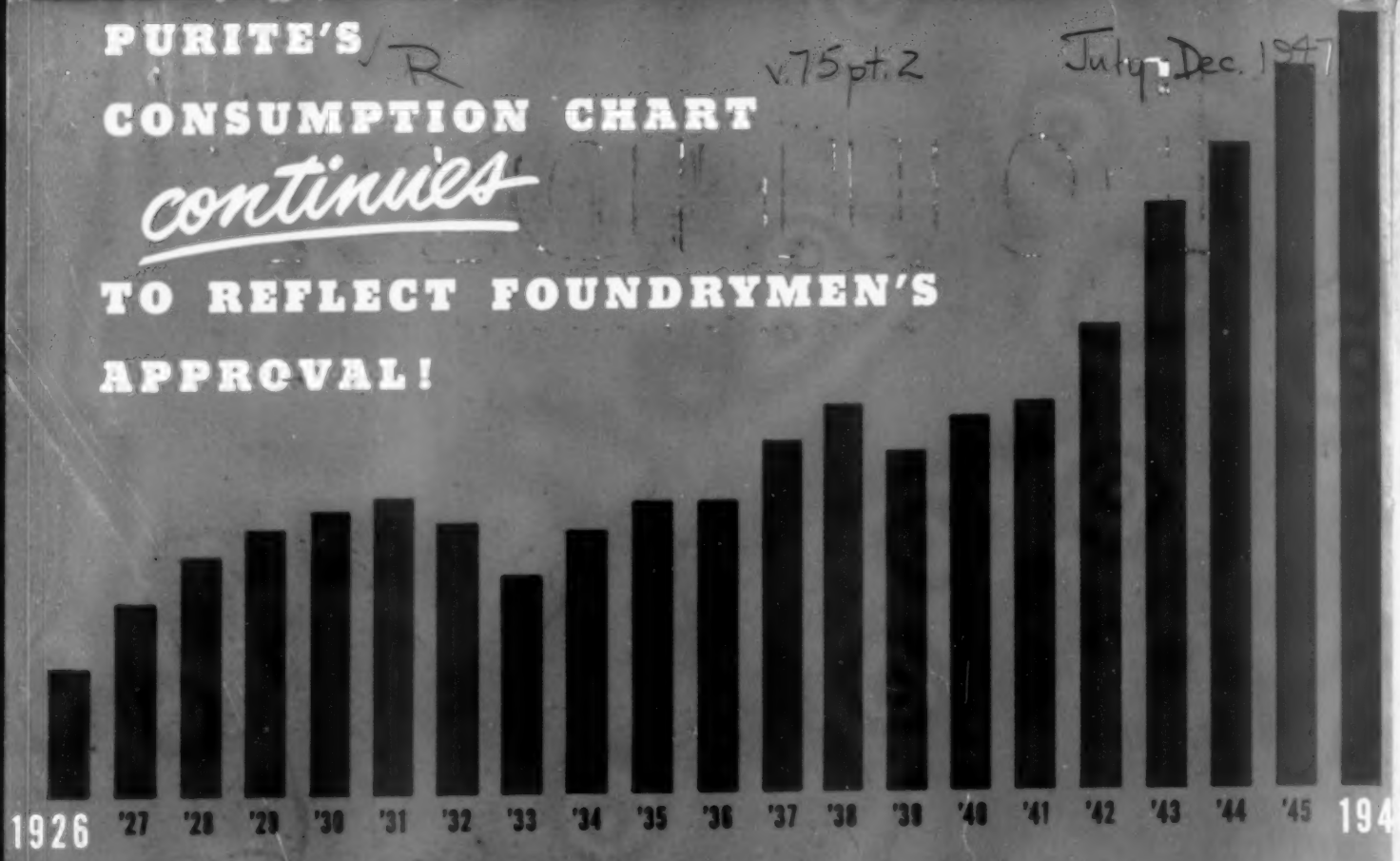
SPO INCORPORATED

Manufacturers and Specialists in Molding Machines, Vibrators and Patterns for Production

1500 ROLAND DRIVE AVENUE — CLEVELAND 5, OHIO

R v.75 pt.2 July-Dec. 1947

PURITE'S CONSUMPTION CHART *continues* TO REFLECT FOUNDRYMEN'S APPROVAL!



99% PURE FUSED SODA ASH

PURITE

The Scientific Flux for Better Melting and Cleaner Iron

The steady climb of this consumption chart over a 20-year span shows what foundrymen think of Purite . . . proves the value of this scientific flux in refining cupola cast iron.

•

PURITE'S remarkable action in desulfurizing and refining iron in the ladle or in the cupola hearth—its effect on combustion—and its action in smoothing out cupola melting operations are the reasons behind the ever-increasing use of Purite by progressive foundrymen everywhere.

Purite does *more* than remove sulfur; it purges molten metal of occluded gases, entrained oxide-silicates and other non-metallic impurities that may cause pinholes, gas pockets and segregated defects. Refining with Purite increases the strength . . . improves grain structure and machinability . . . speeds production of cleaner, sounder castings.

A survey shows that over 70% of the foundries in four principal casting centers in the North, South, East and Midwest are using Purite regularly. You'll want to learn how Purite helps them—how it can help you in these increasingly competitive days, so write for free factual information. *The Mathieson Alkali Works (Inc.), 60 East 42nd Street, New York 17, N. Y.* In Canada: Railway & Power Engineering Corporation, Limited.

Mathieson
CHEMICALS

Purite (Fused Soda Ash) • Liquid Chlorine • Caustic Soda • Soda Ash • Bicarbonate of Soda • Ammonia, Anhydrous & Aqua • Sodium Chlorite Products • Chlorine Dioxide • HTH Products • Synthetic Salt Cake • Dry Ice • Carbonic Gas • Sodium Methylate

Tech

PURPLE STRAND *Means* "ALL THREE"

TECHNOLOGY DEPARTMENT

PUBLIC LIBRARY
JUN 28 1947
DETROIT

When buying foundry rope, what's your first demand?

Strength?

Long life?

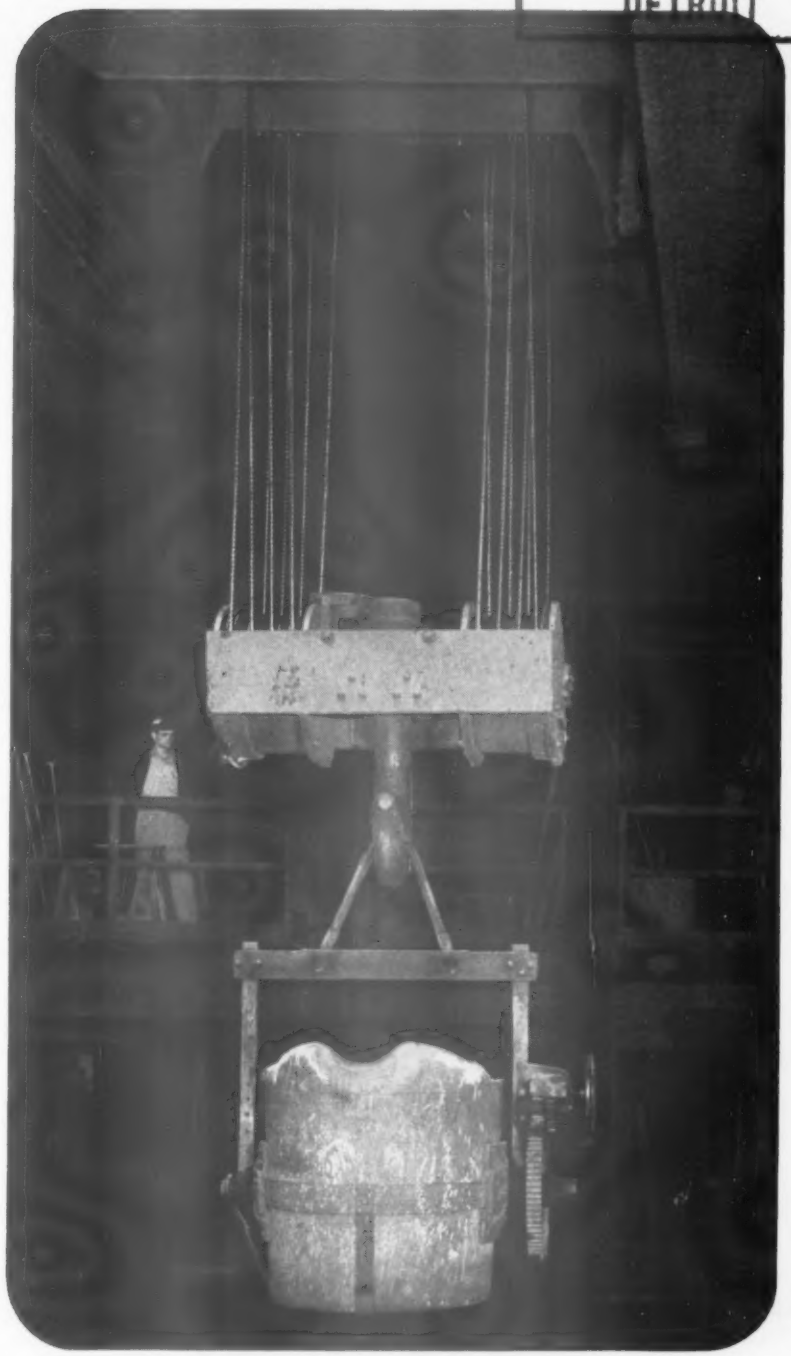
Dependability?

Actually, all three are "firsts." And you get all three in Bethlehem's Purple Strand—the quality wire rope for cranes, air and electric hoists, and other foundry applications.

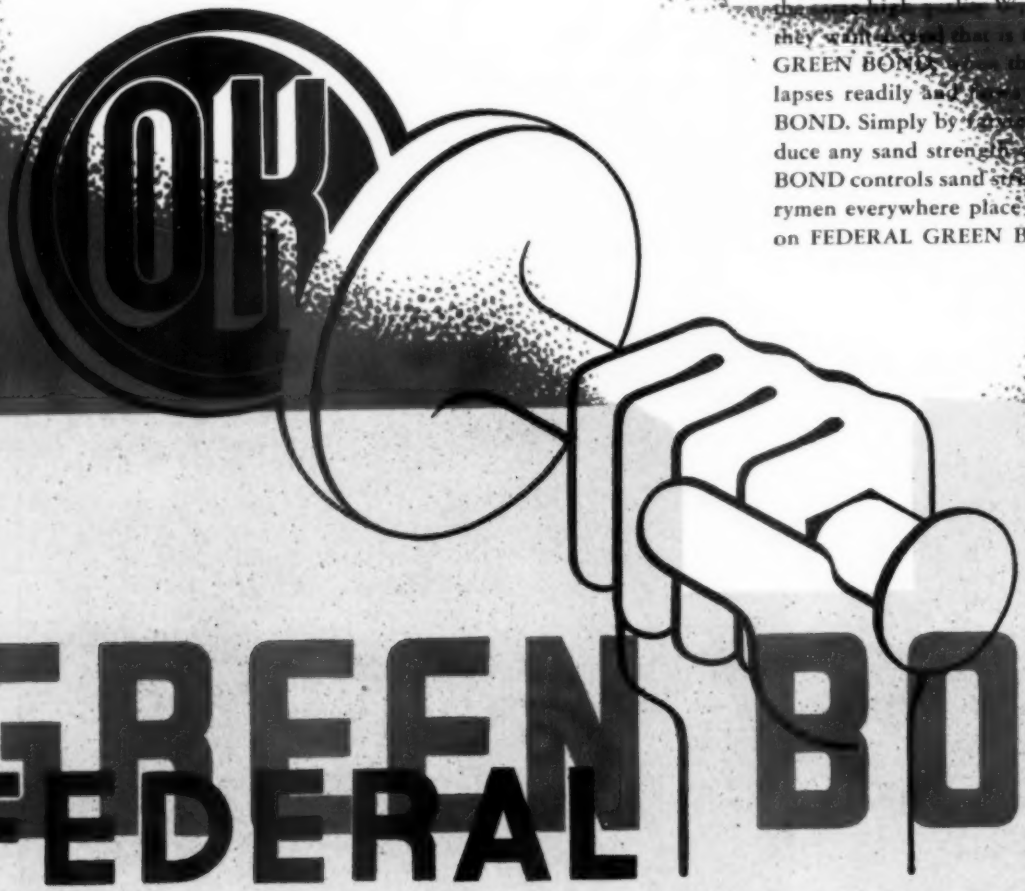
Purple Strand is a trustworthy rope. Need more be said?

BETHLEHEM STEEL COMPANY
BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation



When you think WIRE ROPE . . . think BETHLEHEM



They "OK" it because FEDERAL GREEN BOND is always uniform, always dependable and always

they want a sand that is firm and stable, they use GREEN BOND. ... they want a sand that collapses readily and flows freely, they use GREEN BOND. Simply by varying the mix, they can produce any sand strength desired, because GREEN BOND controls sand strength. This is why foundrymen everywhere place their stamp of approval on FEDERAL GREEN BOND.

FEDERAL GREEN BOND

The Best of the Wyoming Bentonites

THE FEDERAL FOUNDRY SUPPLY COMPANY

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CROWN HILL, W. VA. • CHICAGO • CHATTANOOGA, TENN. • DETROIT • MILWAUKEE • NEW YORK • ST. LOUIS • RICHMOND, VA. • UPTON, WY(Mines

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Pacific Graphite Works, Oakland, Calif. • LaGrand Industrial Supply Co., Portland, Ore.
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THE FOUNDRY

for JULY 1947

VOLUME 75 NUMBER 7

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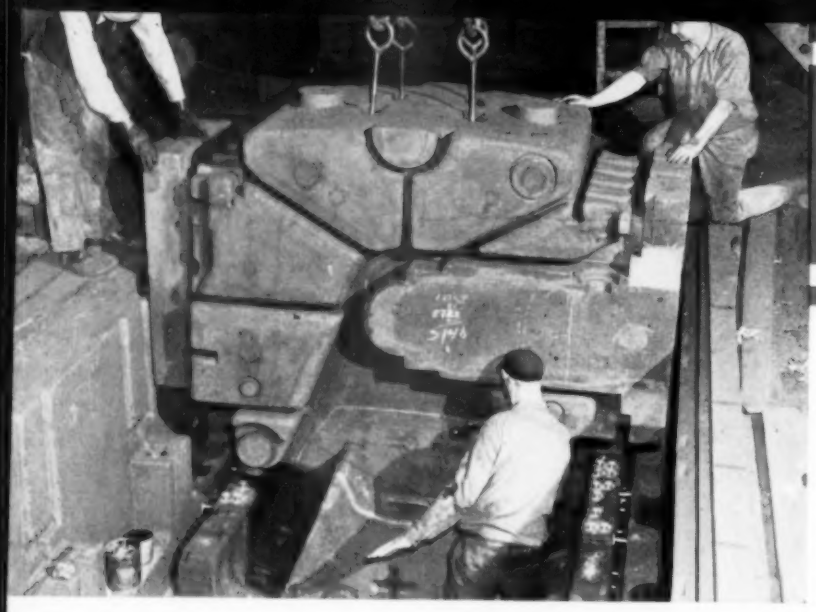


"DADDY."

by

COOPER-BESSEMER at Mt. Vernon, Ohio

"Daddy" was the nickname given to the first casting of a group of five new-type gas engine compressors being built for the Panhandle Eastern Pipeline Co. This was a difficult job. Cooper-Bessemer contracted to build five huge engines they had never made before and they had to do it on a closely estimated figure. As all of the problems and "angles" were worked out with the utmost care and precision, this job took on something of a personality. So much depended on everything being exactly right that "daddy" was almost a real person.

another LINOIL story

First, a special pit, 28′ long, 12′ wide, and 10′ deep, had to be dug in the foundry floor and lined with dry-sand cores. Then, the big 8 ton journal cores were made and lowered into position. Finally, all was ready, and this 30 ton Meehanite metal casting was poured in 2 minutes, 15 seconds. It came out perfect. No blows, no distortions, no flaws. Everything as predicted.

Many things made this success possible. Good design, fine workmanship, and dependable materials. If one had failed, "daddy" was lost. But Cooper-Bessemer took every precaution against failure. They are old LINOIL users. They count on LINOIL'S absolute UNIFORMITY to guarantee the results they must have everytime they pour. Just imagine what the loss of a 30 ton casting would mean. Multiply that for five castings that size. Here's where LINOIL'S uniformity really pays off.

THE LINOIL — THE LOGICAL OIL

WERNER G. SMITH COMPANY

(DIVISION OF ARCHER-DANIELS-MIDLAND COMPANY)

2191 WEST 110th STREET — CLEVELAND 2, OHIO

A MODERN ROTOBLAST TABLE DOES THE WORK OF 2½ TO 3 AIRBLAST TABLES OF COMPARABLE SIZE!

44-lb. pump housings (very dirty coming from the shake-out) cleaned at the rate of one ton per hour . . . master connecting rods cleaned at better than double the rate of barrel-cleaning . . . miscellaneous gray iron castings, varying from 10 to 75 lb., cleaned at the rate of 13 tons per 4 hours . . . castings for stoves cleaned at the rate of over 5000 lbs. an hour (more than could be handled by 23 tumbling mills) . . . those are some of the cost-cutting production rates being obtained with the modern Pangborn ROTOBLAST* Cleaning Table. In every case, too — quality of finish was improved!

*Trademark of the Pangborn Corporation

ROTOBLAST stream at 45° angle cleans tops and all sides as Auxiliary Work Tables revolve the work. This is Type LG. Type LF uses 90° angle, work passes through blast stream in fixed position.

urning the tables

ON THE TREND OF CLEANING COSTS

Take a minute to consider just the *time* saved by the versatile Pangborn ROTOBLAST Table machine which uses metal abrasive and centrifugal force to do the cleaning. It takes the work as it comes — no waiting for batches of similar character. All exposed surfaces are offered directly to the abrasive stream — merely turning the work over for a second pass accomplishes the complete job. Loading and unloading are done while cleaning is in process.

Then add further advantages. Ability to handle fragile work or the general run of jobbing work. None of the breakage experienced with tumbling. Variable cleaning speeds. Work brought before operator's eyes — for inspection. Uniformly high quality of finish.

There are types and sizes of Pangborn ROTOBLAST Tables to cover all general needs including shot-peening — plus many jobs for which no other standard equipment is suitable. For new Bulletin No. 215, write Pangborn, *world's largest manufacturer of blast cleaning and dust control equipment*. Pangborn Corporation, 1300 Pangborn Boulevard, Hagerstown, Md.

LG Type Pangborn Table cleaning large castings at 40-50 tons per 7½-hr. day.

ROTOBLAST

BLAST CLEANS CHEAPER WITH THE RIGHT EQUIPMENT FOR EVERY JOB

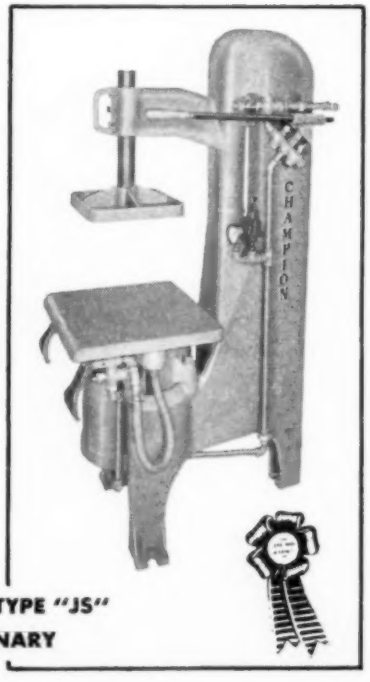
Pangborn

PANGBORN CORPORATION, HAGERSTOWN, MARYLAND

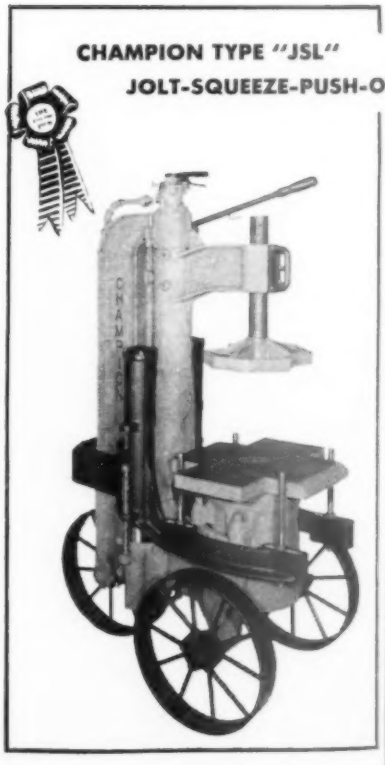
"Coming

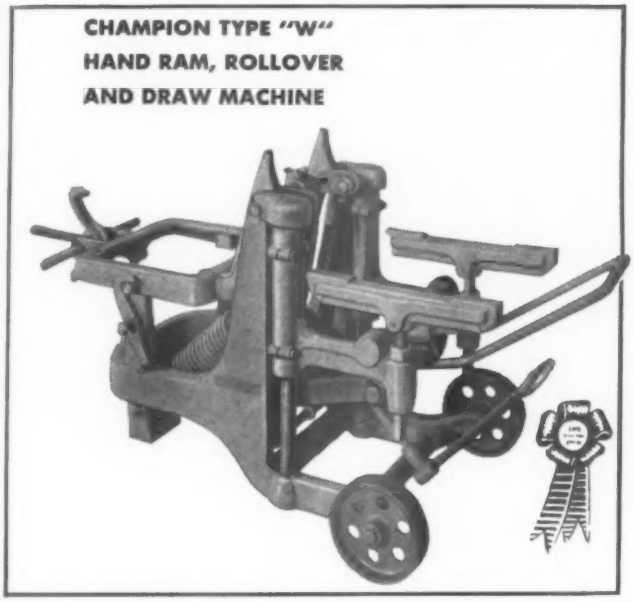
CHAMPION TYPE "JS"
PORTABLE JOLT-SQUEEZER

CHAMPION TYPE "JS"
STATIONARY

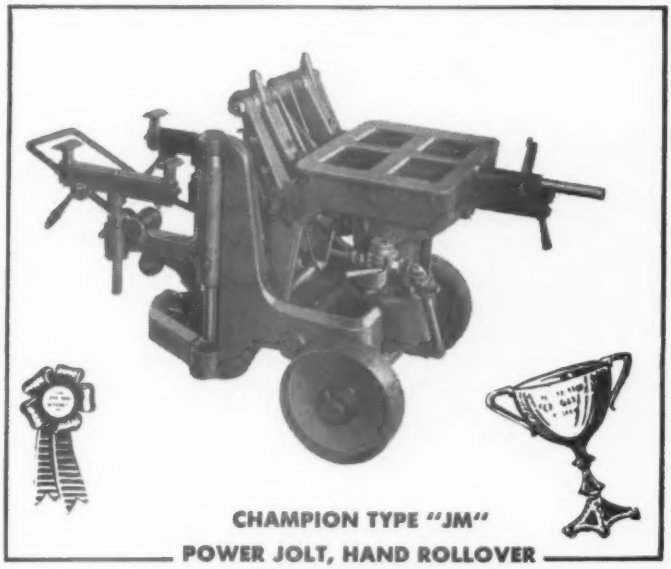


CHAMPION TYPE "JSL"
JOLT-SQUEEZE-PUSH-OF





CHAMPION TYPE "W"
HAND RAM, ROLLOVER
AND DRAW MACHINE



CHAMPION TYPE "JM"
POWER JOLT, HAND ROLLOVER
AND DRAW MACHINE

Down the Stretch"

CHAMPIONS TAKE THE LEAD IN THE "PRODUCTION HANDICAP"

What industry has been through the past year or so could be called a "Grand National"; with everyone taking the same hedges and ditches, the same obstacles to production. We are glad to feel that the worst is over, and those of our customers who have been waiting for new Champion molding machines will be glad to know that we are cutting weeks off our deliveries.

MOST TYPES ARE NOW BEING SHIPPED FROM STOCK

Soon our victory over shortages, delays and other handicaps will enable you too, to step up your production and shorten your deliveries.

Perhaps this is the time for you to go over your whole production set-up and figure where some Champion equipment would improve your over-all production picture.

Champion Molding Machines and Core Blowers, true to their name, meet the challenge of our current situation by making it possible for less-skilled workers to turn out more and better molds and cores, thus reducing costs on a major operation in foundry work and by raising his productivity they broaden the opportunity for the worker.

Furthermore, Champion Molding Machines are designed and constructed for long life and trouble-free operating, as demonstrated in leading foundries of the world today.

CHAMPION FOUNDRY AND MACHINE CO.
1318 W. 21st STREET CHICAGO 8, ILLINOIS

ANOTHER FAMOUS FOUNDRY

by DELTA

There is a type of DELTA Spray Binder for every type of sand cast metal.

SPRAY BINDERS

DELTA Spray Binders, applied to green sand molds and cores, produce unusually hard, waterproof surfaces which resist cutting and penetration by molten metal.

They are easily and quickly applied with a spray gun and, when used as directed, leave a baked-like dry sand surface over which molten metal flows freely and smoothly.

Note the important time — and money-saving benefits of using DELTA Spray Binders in your foundry.

Ask for a liberal working sample. You will also receive complete instructions for use. Write today.

HERE ARE THE BENEFITS OF USING DELTA SPRAY BINDERS

1. FASTER PRODUCTION.
2. Produce rapid SKIN DRY and DRY SAND surfaces on molds.
3. Mold surfaces are WATER-PROOFED and HARDENED, resisting cutting action and penetration by molten metal.
4. SAVE TIME, FUEL and LABOR by eliminating oven drying or torch drying of molds.
5. CUT CLEANING ROOM COSTS and produce smoother casting finish.
6. ECONOMICAL to use.
7. EASILY, QUICKLY APPLIED.

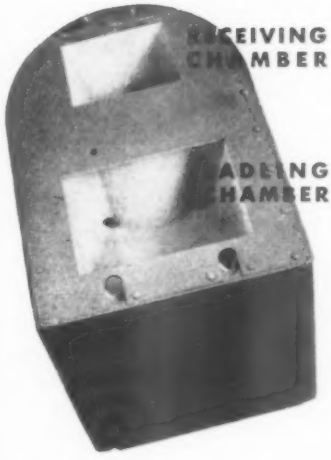
DELTA OIL PRODUCTS CO.

MILWAUKEE 9, WISCONSIN

Announcing a new "two-chamber" holding furnace

the LINDBERG-*Fisher*
ELECTRIC INDUCTION HOLDING FURNACE for aluminum

...with the same new features as its companion unit, the Lindberg-Fisher Electric Induction Melting Furnace.



The Lindberg-Fisher has these advantages!

Continuous ladling. This is possible because of the "two-chamber" design. Ingots or molten metal can be added to the receiving chamber within reasonable operating limits, without lowering ladling chamber temperature.

Cooler operation. Chambers carry insulated covers—protect operators from heat—minimize heat loss. Induction heating heats metal only, not the entire furnace. Large ladling chamber at convenient working height makes ladling easier.

Temperature flexibility. Furnace can be turned down to operate at a low overnight or weekend stand-by temperature. This eliminates lost "starting-up" time.

Doubles as melting furnace in shops requiring small melting capacity.

Accurate temperature control—so important in making sound castings—is provided for electronically.

Quick delivery. Available in 300, 500, and 1000 lb. holding capacities.

Write for additional information.

Now . . . a complete line of melting and holding furnaces—gas, oil, electric

Fisher Furnaces

A DIVISION OF LINDBERG ENGINEERING CO.

2453 WEST HUBBARD STREET • CHICAGO 12, ILLINOIS

LOW COST HEATING

with—

LOW INITIAL COST

LOW MAINTENANCE COST

LOW OPERATING COST

AVAILABLE IMMEDIATELY

Add together the savings in initial equipment cost, operating expense and maintenance charges obtainable with Dravo Heaters and you have gone a long way in helping to offset the unusually high cost of building today.

And Dravo Counterflo Heaters have other money saving advantages too: the interchangeability of gas burners with oil burners; the combination gas-oil burning arrangement available at purchaser's option; the large capacities ranging upward from 400,000 Btu output; control and fan systems arranged for summer ventilating service; stainless steel chamber for extra long life.

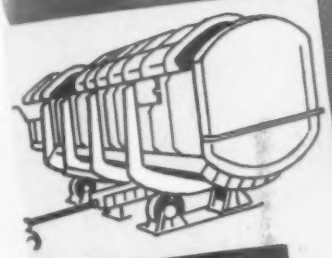
Since Dravo Heaters are *available immediately* in stock, you can use the summer ventilating feature now and be prepared for comfort heating next season. Write for Bulletin FG-516 for full description.

DRAVO CORPORATION

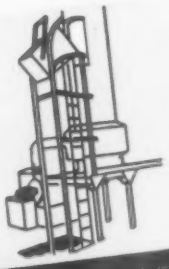
Pittsburgh · Philadelphia · Cleveland · New York
Detroit · Atlanta · Wilmington

DRAVO

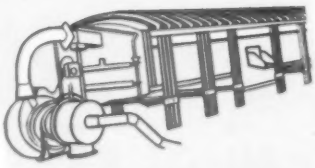
LOWER COST HOT METAL
through Scientific Melting



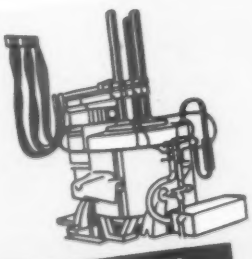
CRADLE FURNACES . .



CUPOLAS . . .



AIR FURNACES . . .



ELECTRIC FURNACES . .

Continual improvements in both foundry practice and melting equipment are leading to better control of analysis, higher pouring temperatures, less power disturbances, and reduced costs.

Whiting engineers are in intimate, constant touch with this progress... in many cases their recommendations have made important contributions. Long experience with practical foundry operations has enabled them to initiate numerous improvements.

Whiting sales engineers have no "ax to grind" because Whiting can supply any and every type of melting equipment which the special conditions in your foundry may dictate. We invite you to consult them.

WHITING CORPORATION

15607 Lathrop Avenue, Harvey, Illinois

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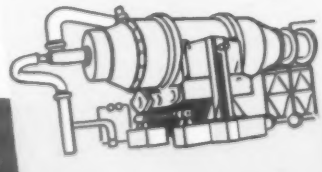
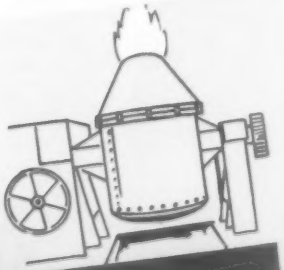
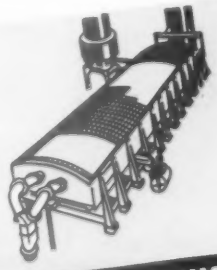


ROTARY FURNACES . .



CONVERTERS . . .



DUPLEXING SYSTEMS

SAND IS NO PROBLEM

AT LAKEY FOUNDRY AND MACHINE CO.

HOUGH "HUFF" Payloader PATENTED

SAVES — 45 MANHOURS — 10½ WORKING HOURS — 88¢ PER TON

When not unloading cars, Lakey uses the HA Payloader to haul sand from storage to mechanical elevators. The average round-trip haul is 200 feet yet the HA averages 14 tons per hour and uses only ½ gallon of gasoline per hour.

Lakey also uses the HA to haul refuse and for odd jobs of digging, loading and carrying — making full use of the versatility and the all-around utility that is built into Hough Payloaders.

The Lakey Foundry & Machine Co. of Muskegon, Michigan, is sold on Hough Payloaders when it comes to handling sand or other bulk material. Their HA is constantly on the move — busy saving time, man hours and money at every turn.

Lakey uses an HA Payloader and one man to unload a car of core sand in 1½ hours — moving swiftly within the close confines of the car — unloading at the amazing rate of 33 tons per hour. Previous to using the Payloader, it required four men with wheelbarrows working 12 hours to unload a car. *time saved*—10½ hours. *Man hours saved*—45. *Money saved* — 88 cents per ton.

This is indicative of the steady, efficient performance of Hough Payloaders working all over the world — the result of over twenty-five years of engineering and designing experience in the development of material handling equipment — your guarantee of outstanding performance at all times from Hough Payloaders. Send for literature today.

THERE ARE OVER 6500 HOUGH SHOVELS IN SERVICE

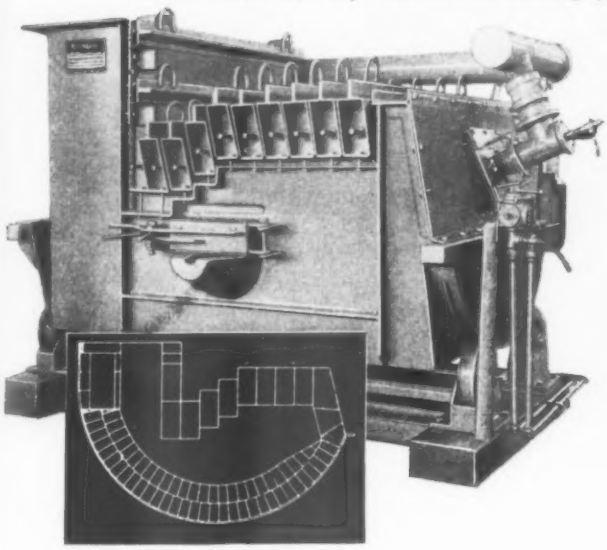
THE FRANK G. HOUGH CO.

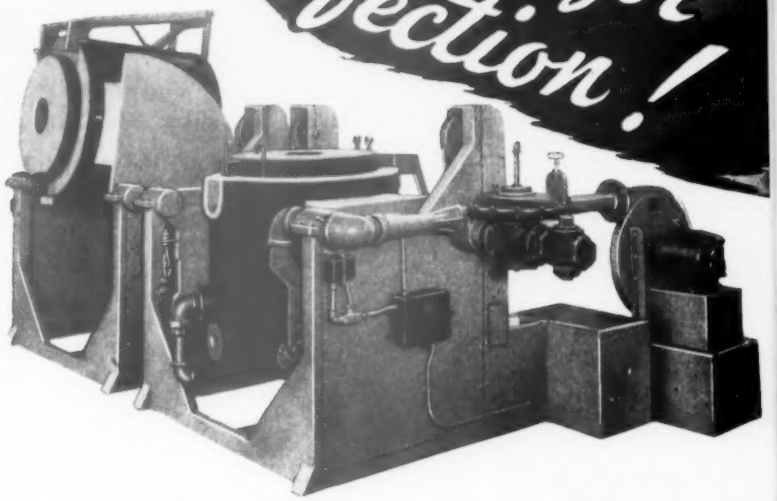
MATERIAL HANDLING EQUIPMENT SINCE 1920

703 Sunnyside Ave. Libertyville, Ill.

STROMAN FURNACES are Engineered for Perfection!

When you install a Stroman Furnace in your foundry, die casting or permanent mold plant you will be astounded at its extremely efficient operation . . . great economy in fuel consumption...speed of melting time and ease of handling. Stroman Furnaces have proved themselves to be the best available for any non-ferrous melting job. Write today for complete information





SKLENAR FURNACES

For melting Brass, Bronze or Aluminum, Sklenar Non-Crucible, Direct Fired, Reverberatory Melting Furnaces, are the fastest ever built. Their Design is unique. Metal is charged into a hopper which is also an exhaust from the combustion chamber. Here metal is preheated and melted at the throat of the hopper. Cold metal does not reach the molten bath. Charging is continuous. These furnaces will show fuel savings up to 40%; as the combustion chamber is heated by the same fuel that is used to melt the metal at the throat of the hopper. They are also very successful in the making of Grey Iron Castings. The furnace illustrated is the 1200 lb. (brass capacity) size, and is oil fired. Gas fire is also available. Full information upon request.

STROMAN MECHANICAL OR HYDRAULIC TILT CRUCIBLE MELTING FURNACES

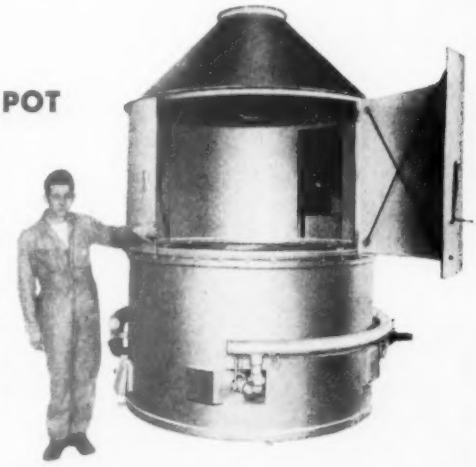
For Brass, Bronze, Aluminum and other non-ferrous metals. These Stroman Furnaces embody the famous Stationary Lip Pour Feature which assures a constant pouring arc, eliminating the necessity of moving the ladle at any time during a pour. They are excellent for use in permanent mold and die casting plants as well as any foundry. Their sturdy construction assures longest life, and their economical operation results in lowest production costs. Choice of oil or gas fire. Built in sizes to handle capacities from No. 125 to No. 400 crucible.

STROMAN CRUCIBLE STATIONARY MELTING FURNACES

For Brass, Bronze, Aluminum and other non-ferrous metals. Sturdy, efficient and featuring the Stroman Push-Back Cover these stationary furnaces are designed for peak production and greatest fuel economy. Oil or Gas Fire. Capacities from No. 20 to No. 400 crucible.

STROMAN IRON POT STATIONARY MELTING FURNACES

These furnaces are highly recommended as break down furnaces for zinc die casting plants. They also excel as aluminum holding furnaces. They can be supplied with or without hoods to exhaust fumes and heat. Their construction assures longest pot life and lowest fuel costs. Choice of manual or automatic controls and gas or oil fire. Capacities from 212 to 14,000 lbs. of zinc. Other metals in proportion.



Write for Complete Information at Once

STROMAN FURNACE & ENGINEERING CO.

DIVISION OF

THE PETERSEN OVEN CO. • 9900 FRANKLIN AVE. • FRANKLIN PARK, ILL.

Here's new light on lower grinding costs

Old-fashioned methods of figuring grinding costs can easily keep you in the dark.

Worse yet, they give false information that wastes dollars every day.

If you want to see the light on your grinding costs, here's a simple way that has already saved a lot of money for men in your own industry.

We're talking about the Peninsular method of calculating true expenses by careful analysis of all factors that influence grinding costs.

Peninsular engineers, who do the job, have specialized in grinding problems since 1889. And in almost every case they've worked on, *they have been able to cut production expenses appreciably.*

The Peninsular Grinding Wheel Co., 729 Meldrum Ave., Detroit 7, Michigan. *Sales Offices:* Chicago, Philadelphia, Boston, Buffalo, Cleveland, Pittsburgh, Houston, St. Louis, Cincinnati.

PENINSULAR

INDIVIDUALLY PENINSULAR *ENGINEERED*

GRINDING WHEELS

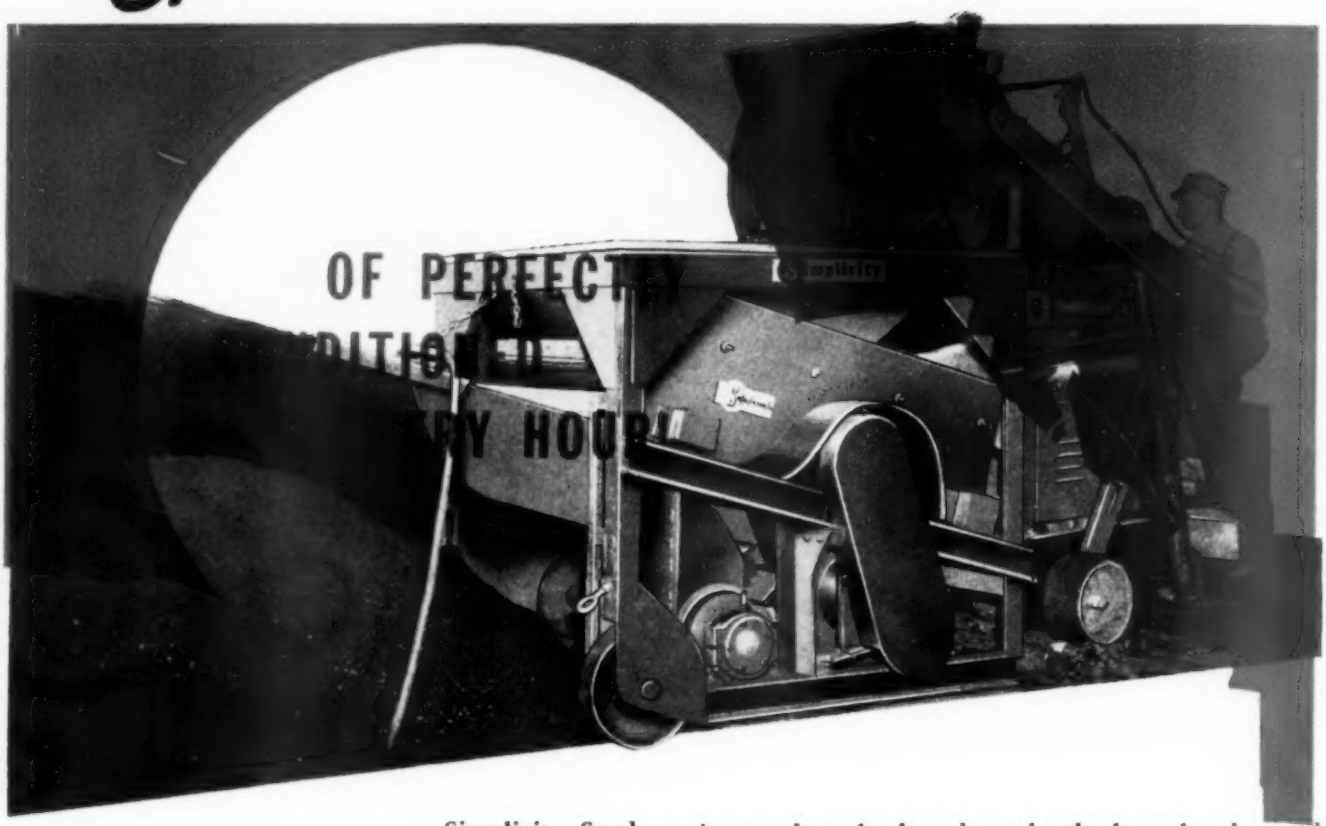
SINCE 1889

SPECIALISTS IN RESINOID BONDED WHEELS

Actual grinding wheels make this lamp—a cup wheel shade, a cylindrical grinding wheel stem, and a dish wheel base.

DETROIT PUBLIC LIBRARY

Get 30 to 40 tons



WITH THE NEW SIMPLICITY 4' X 4' SAND SCREENING AND CONDITIONING UNIT

Simplicity Sand Screening Units solve the problem of proper sand conditioning in foundries not equipped with elaborate sand handling systems. For example, the 4′ x 4′ Semi-Portable Model, shown on the job at Brown Industries, Sandusky, O., screens, aerates, and fluffs 30 to 40 tons per hour. This model is built low and with sufficient maneuverability to permit both loading and moving to be accomplished with a front loading shovel, as illustrated. In operation, the 4′ x 4′ Semi-Portable is typical of all similar Simplicity equipment. Sand is shoveled on the screen. All foreign particles are passed to a vibrating chute and discharged, while fluffs and balls of good moulding sand are broken down by the lump-breaker and passed through the screen. Screened sand is then conveyed to the aerator and thrown into fluffy windrows, or heaps, thoroughly aerated and mixed and ready for the moulder.

Simplicity Portable and Semi-Portable Sand Screening Units are made in 5 sizes: 12″ x 18″, 2′ x 3′, 3′ x 6′, 4′ x 4′, and 4′ x 8′. Write for complete information.

MEMBER MANUFACTURERS ASSOCIATION INC. FOUNDRY EQUIPMENT

INVESTIGATE...

implicity

TRADE MARK REGISTERED

ENGINEERING COMPANY

THEN YOU'LL INVEST IN SIMPLICITY

DURAND, MICHIGAN

150 minutes slashed off production time

Formerly, the Pittsburgh Steel Foundry Co. removed sixty-pound riser pads from cast steel locomotive drive wheels by grinding . . . a slow, laborious procedure that took 3 hours per wheel.

Now, using Airco's modern flame scarfing technique, similar riser pads are removed in thirty minutes; thus 150 minutes of grinding time per wheel are eliminated, castings are ready for finish machining.

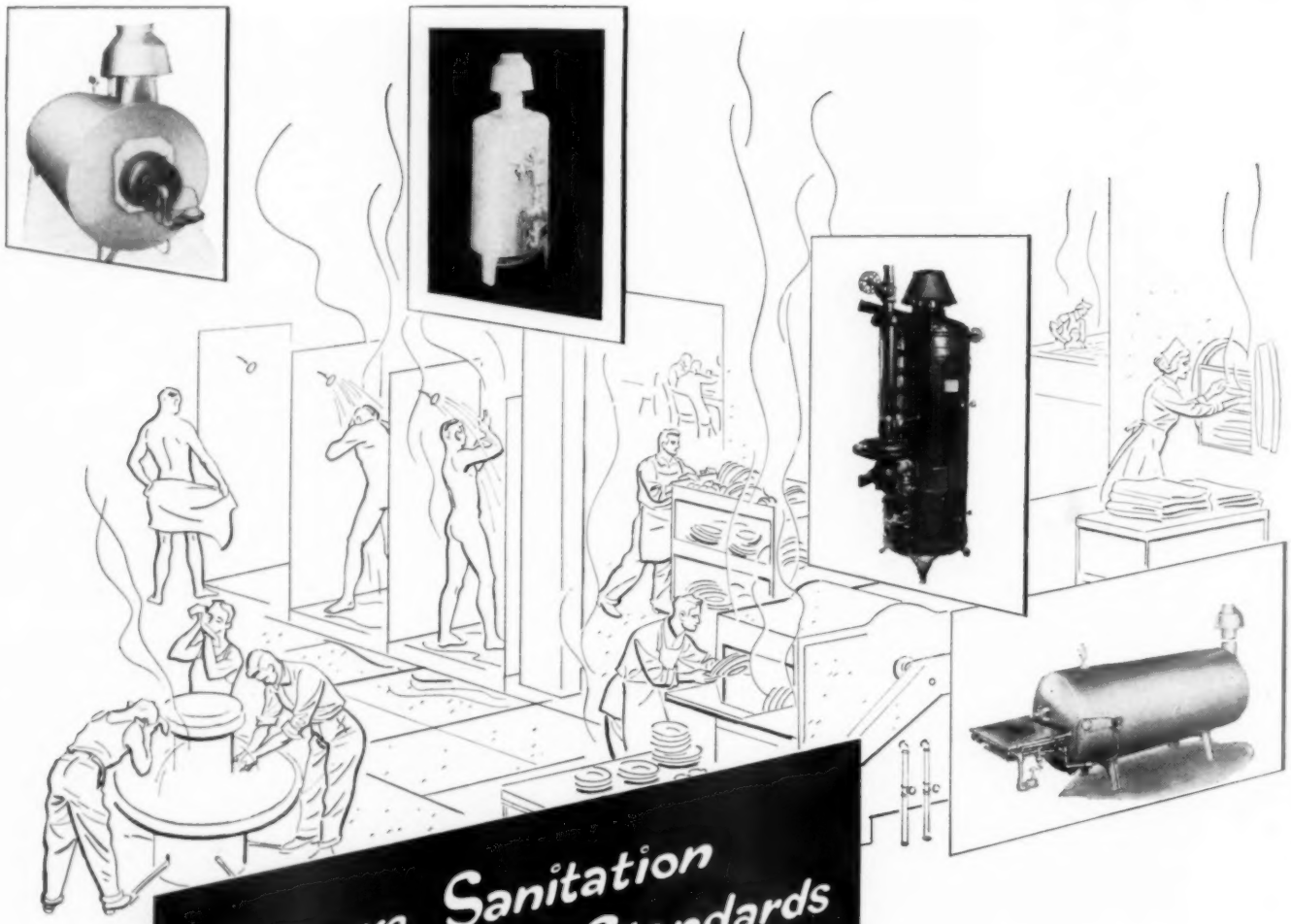
This is another example of the manner in which Airco modern oxyacetylene and electric arc methods are helping progressive foundry operators slash production time and costs.

For details of other applications of these two versatile production tools in foundry operations, write for a copy of "New and Improved Oxyacetylene Methods for Steel Foundries". Address Dept. F-6786, Air Reduction, 60 East 42nd St., New York 17, N. Y. In Texas: Magnolia Airco Gas Products Company, Houston 1, Texas. Represented Internationally by Airco Export Corporation.

AIRCO **AIR REDUCTION**

Offices in All Principal Cities

HEADQUARTERS FOR OXYGEN, ACETYLENE AND OTHER GASES...CARBIDE...GAS WELDING AND CUTTING APPARATUS AND SUPPLIES...ARC WELDERS, ELECTRODES AND ACCESSORIES



High employee morale, and superior health standards among workers, pay substantial dividends by increasing individual efficiency in modern industrial productioneering.

When you provide wash fountains, showers, first aid facilities, cafeteria accommodations you're taking the first important step. But the next step is even more important—you must furnish an adequate and constant supply of hot water at just the right temperatures for every purpose.

Modern GAS Water Heaters fulfill every requirement for hot water for sterilizing, dishwashing, showers, industrial laundries. With Gas-fired Water Heaters you can obtain a constant supply of water at any specified temperature and in any desired quantity.

The economy, flexibility, and speed of GAS and modern Gas Water Heating Equipment have been established in hundreds of installations. Your local Gas Company Representative will aid you in selecting equipment for your needs.

AMERICAN GAS . ASSOCIATION

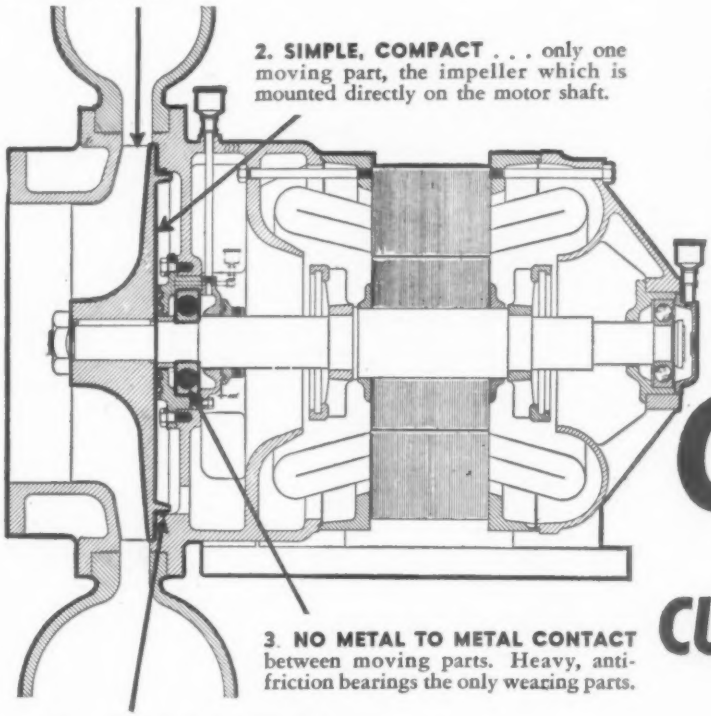
420 LEXINGTON AVENUE, NEW YORK 17, N. Y.

MORE AND MORE...

THE TREND IS TO GAS

FOR ALL VOLUME WATER HEATING

1. BOTH BLOWER AND MOTOR built by Allis-Chalmers, designed to operate together . . . entire responsibility rests in one company.

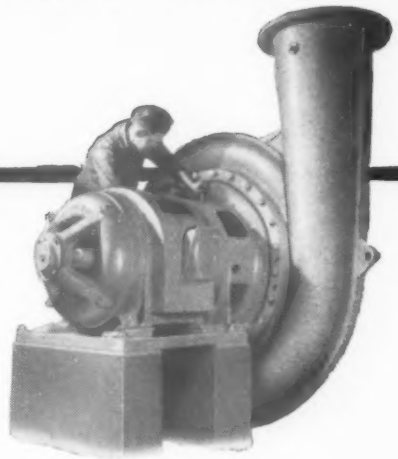


2. SIMPLE, COMPACT . . . only one moving part, the impeller which is mounted directly on the motor shaft.

3. NO METAL TO METAL CONTACT between moving parts. Heavy, anti-friction bearings the only wearing parts.

4. SEAL RING ON IMPELLER balances end thrust . . . reduces bearing loads to a minimum.

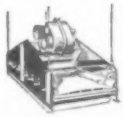
IT PAYS TO Specify Allis-Chalmers CUPOLA BLOWERS!



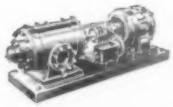
IT'S JUST SOUND BUSINESS to have *all* the facts in selecting a cupola blower. A check with your consultants or engineers will disclose for example, that: the design of *Allis-Chalmers* blowers stems from *60 continuous years* building high-speed rotating equipment. Further, *hundreds* of A-C cupola blowers have been furnished . . . and the very first units are *still operating!*

The blower is only a *small* part of total cupola investment . . . yet it's a *big* factor in overall operating economy. That's why we say —compare *before* you buy . . . prove to yourself that it pays to specify "Allis-Chalmers". Ask your engineers. ALLIS-CHALMERS, MILWAUKEE 1, WISCONSIN.

A-C BUILDS BASIC MACHINES, BLOWERS, PUMPS, DRIVES, ELECTRICAL EQUIPMENT FOR FOUNDRIES



YOU GET BUYER'S CHOICE in Allis-Chalmers complete foundry screen line. *Low-Head, Aero-Vibe, Ripl-Flo* and *Utah* electric screens handle every foundry screening.



ROTARY AIR COMPRESSORS for operation of foundry air tools. *Ro-Flo* units are quiet in operation . . . light in weight . . . will run for years with a minimum of maintenance.

MOTORS OF EVERY TYPE, from 1 hp up, for all foundry power requirements. Totally enclosed, fan-cooled motors keep out dirt . . . require less maintenance.

SEND FOR NEW BULLETIN 07B6092A, "Foundry Mechanization" — It's packed with helpful, usable information on the *entire* Allis-Chalmers line of heavy foundry equipment.

A 2186

ALLIS-CHALMERS

One of the Big 3 in Electric Power Equipment — Biggest of All in Range of Industrial Products

1847 1947 A CENTURY OF SERVICE to Industry THAT MADE America Great

The Diamond-like Hardness of NORBIDE Nozzles Increases Wearability • Cuts Costs • Saves Time

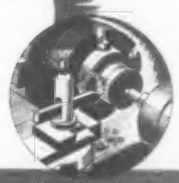
NORBIDE Nozzles are made of Norton Boron Carbide, the hardest material made by man for commercial use. This great hardness—second only to the diamond—enables NORBIDE Nozzles to last hundreds of hours where less wear-resistant nozzles wear out in only a few hours. Nozzles which wear quickly are large consumers of air. They soon become ineffective, and time is wasted because of the frequency with which worn-out nozzles must be replaced. The guarantee for NORBIDE Nozzles is 750 hours with silica sand or 1500 hours with steel grit before orifice enlarges one and one-half times its original diameter (their life usually far exceeds this guarantee). With NORBIDE Nozzles air consumption is reduced 10 to 20% and abrasive velocity is more uniformly maintained with the maximum of cleaning efficiency and economy.

NORTON COMPANY

Worcester 6, Massachusetts

LIGHT WEIGHT, MACHINABILITY

MY CONDUCTIVITY IS HIGH



what am I ?

I'M BRIGHT AND HANDSOME TO THE EYE

AGAINST CORROSION I FIGHT WELL

MY TOUGHNESS AND MY STRENGTH EXCEL

I could be Utopium, the wonder alloy of the future. But I'm not. I'm not any *one* metal! I'm a whole family of non-ferrous metals...Federated metals.

For versatility and economy, I may be tin bronze . . . for light weight and good machinability, an aluminum alloy . . . for conductivity, a high copper alloy . . . for ornamental value, nickel silver . . . for enduring resistance to corrosion, aluminum bronze . . . for high tensile strength, manganese bronze.

Each of these alloys is used for a specific purpose. But how different those purposes may be! So different that it is obviously impossible to prescribe one composition suitable for such a multitude of applications. The selection of the *right* alloy, therefore, is vitally important to certain success.

The right alloy can always be found in Federated's *complete line* of foundry metals. And, when necessary, the friendly Federated service man has the knowledge and the willingness to assist you in your choice.

To order, or to obtain further information, call or write any of Federated's twenty-five sales offices from coast to coast, or *Federated Metals Division, American Smelting and Refining Company, 120 Broadway, New York 5, New York.*

Federated

FMD

Federated first in the non ferrous field

METALS DIVISION

AMERICAN SMELTING AND REFINING COMPANY

JMLCO F-617

KAISER ALUMINUM

HOW PERMANENTE METALS—IN A SINGLE YEAR—HAS BECOME A KEY FACTOR IN AMERICAN INDUSTRY—PRODUCING 175 MILLION POUNDS OF KAISER ALUMINUM!

One year ago, for the second time in over half a century, a new force stirred the aluminum industry.

After careful planning and organization, The Permanente Metals Corporation—led by Henry J. Kaiser and associates—started to carve out a permanent place in the aluminum world.

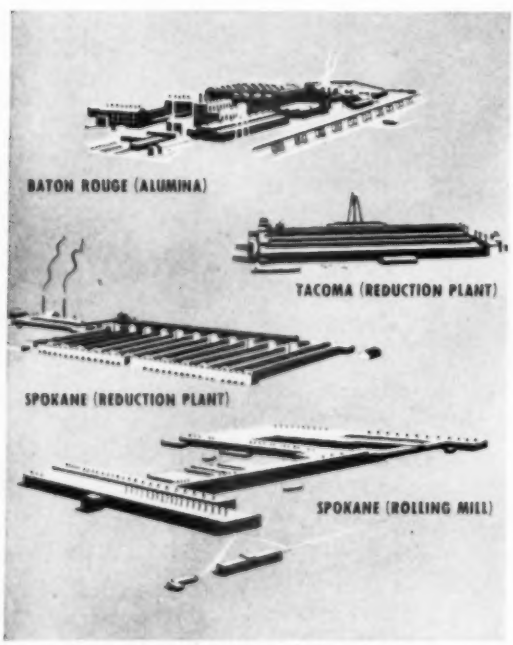
The first objective: To produce aluminum in tremendous volume and thus offset the shortage which was then crippling the production of finished products.

That this objective was achieved . . . and surpassed . . . is revealed by one statistic—175 million pounds of plate, sheet, and strip aluminum in the first year. Almost as much as the entire industry produced in the most productive year before the war!

The pictures and text on these pages *partially* reveal how this was done.

What they cannot hope to portray is how administrative vision, technical skill, and a completely coordinated operation combined to make such production possible.

This same combination is now achieving Permanente Metals' second objective—to make Kaiser Aluminum, already second to none, the finest in the land!



1. From bauxite processing to finished product—This chart gives a step-by-step picture of Permanente Metals' aluminum operation . . . which controls the production of quality aluminum from its huge bauxite processing plant at Baton Rouge, Louisiana . . . through its mammoth reduction and finishing plants at Spokane and Tacoma, Washington. Such integration assures fast, reliable service.

2. Preparing the "pig"—Operating eight modern pot lines, Permanente's reduction plants at Spokane and Tacoma, Washington, can turn out over 700,000 pounds of pure pig aluminum daily. This pig aluminum is then sent to the rolling mill, also in Spokane, where it is converted into alloyed ingots and then rolled into plate, sheet and strip.

3. Down the "hot line"—Permanente Metals' 53-acre Spokane rolling mill is one of the largest, most modern plants of its kind in the world. An example of its up-to-the-minute equipment is the "hot line," the giant rolls which convert alloyed aluminum ingots into sheet. This rolling mill is capable of producing 288 million pounds of Kaiser Aluminum a year.

4. Quality first—With production reaching new peaks, Permanente Metals is now concentrating on producing the highest quality aluminum ever offered to manufacturers. Constant chemical and physical tests plus infinite care in handling assure that customer requirements are not only met, but exceeded.

5. Ready to go—Here is the result of just one day's rolling mill production of Kaiser Aluminum. Ready to ship, it will go into aircraft, buses, building materials, house trailers, appliances, garage doors, kitchen utensils . . . will be welcomed by scores of America's leading manufacturers who rely on Permanente Metals for quality aluminum, fast, dependable deliveries, and an eagerness to be of service!

Ready to serve you—*today*...

Kaiser Aluminum

a Permanente Metals product

DISTRIBUTED BY PERMANENTE PRODUCTS COMPANY, KAISER BLDG., OAKLAND, CALIFORNIA . . . WITH OFFICES IN:
Seattle, Wash. · Oakland, Calif. · Los Angeles, Calif. · Dallas, Texas · Wichita, Kan. · Kansas City, Mo. · St. Louis, Mo. · Atlanta, Ga. · Minneapolis, Minn. · Milwaukee, Wis. Chicago, Ill. · Cincinnati, Ohio · Cleveland, Ohio · Detroit, Mich. · Boston, Mass. · Hartford, Conn. · Buffalo, N.Y. · New York City, N.Y. · Philadelphia, Pa. · Washington, D.C.

YES you can get high fl with

DEPENDABLE

MINCO BOND

INCREASE YOUR P

- **HIGH FLOWABILITY**
  A characteristic that means easier moldability. Saves time by eliminating sticking and clogging sand in chutes and systems thus increasing production!
- **PERMEABILITY**
  Minco bond increases permeability gradually and maintains it consistently.
- **HIGH DRY STRENGTH**
  A MINCO characteristic that is invaluable in dry sand molding combined with HIGH COLLAPSIBILITY gives cleaner castings *faster*.
- **DURABILITY**
  Minco bonded sands can take a day-in and day-out production pounding, a fact that means re-use economy for your foundry.
- **SHAKEOUT QUALITIES**
  Easier and cleaner shake-out with MINCO cuts cleaning room time, gets production schedules *up*.

WRITE—WIRE—OR PHONE YOUR NEAREST DISTRIBUTO OR

PROCESSED

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2295 University Ave., St. Paul, Minn.

MARTHENS COMPANY
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3211 Bellvue, Detroit, Mich.

flowability!

MINCO PERFORMANCE CANNOT BE EQUALED BY ANY OTHER FOUNDRY BOND OR MOLDING SAND!

THE NEW

MINCO BONDED MOLDING SANDS

PRODUCTION 10%

Yes, you can get high flowability and all the other characteristics of top-quality molding sands in the new MINCO BONDED MOLDING SANDS. High grade Michigan Silica Sands combined with the scientifically correct proportions of MINCO Bond produce a sand that has high Permeability (40 to 150 a 5% moisture) . . . high green strength of approximately 10 psi . . . and more than double the durability of natural bonded sands. These new MINCO sands, which are available in three grades, can be rammed to high mold hardness for superior casting finish, with controlled dimensional stability.

- **GRADE A.F.A.—G.F.N. 105 (Fine)**
  For all non-ferrous and small grey iron and malleable castings where the finest finish is needed.
- **GRADE A.F.A.—G.F.N. 85 (Medium)**
  For use in medium grey iron, malleable and semi-steel castings.
- **GRADE A.F.A.—G.F.N. 65 (Coarse)**
  For large grey-iron, malleable and steel castings.

Increase your production today with the tested MINCO way!

FOR THE ANSWER TO YOUR SAND BONDING PROBLEM.

EXCLUSIVELY BY

CORPORATION

Saginaw, Michigan

PETER J. DAPKUS, FOUNDRY SAND CONSULTANT
640 Atlanta Ave., Webster Grove, Missouri

THE HOFFMAN FOUNDRY SUPPLY CO.
1193 Main, Cleveland, Ohio

Complete Sand Plant for large jobbing foundries

HANDLES 20 TO 50 TONS PER HOUR

THOROUGHLY CONDITIONS SAND

REMOVES SCRAP

LOWER SAND CONDITIONING COSTS 51% WITH A ROYER COMBINATION

Eliminate time and labor consuming methods of sand preparation in large jobbing foundries—The Royer Combination Scrap Remover and Sand Separator and Blender provides fast single-unit sand conditioning. Users report 51% reduction in preparation costs.

Load used sand in hopper at top—scrap, gaggers, burned cores and other contamination are discharged at side. Unit then removes small refuse, thoroughly breaks up sand, blends and mixes, distributes moisture evenly, increases permeability, double aerates, and discharges ideally conditioned sand that assures highest quality castings.

Royer Model NDC, shown in action above, handles 20 to 25 tons per hour. Model RC handles 40 to 50 tons per hour. Unit is flexible—bring sand to it or bring it to sand by overhead crane . . . no pit or foundation required . . . occupies minimum space. Reduce labor costs, increase production, improve casting quality with better sand—send for Bulletin 744 describing Royer's complete line of sand conditioning equipment.

MANUFACTURERS ASSOCIATION, INC. FOUNDRY EQUIPMENT

ROYER

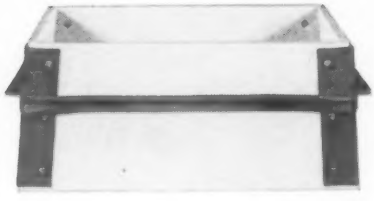
FOREMOST IN SAND CONDITIONING EQUIPMENT

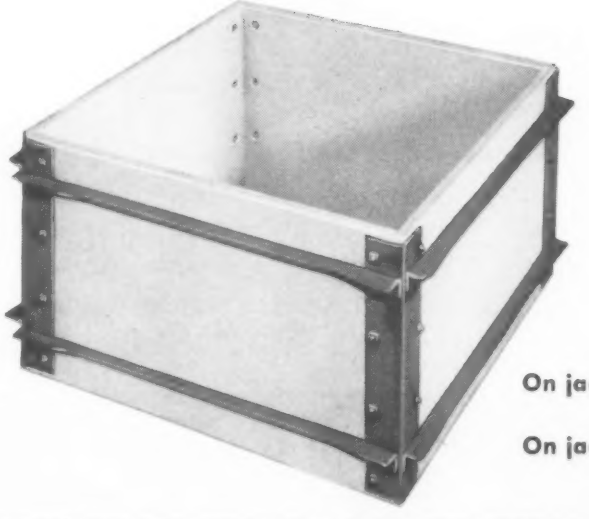
ROYER FOUNDRY & MACHINE CO.

KINGSTON, PENNSYLVANIA

MOLTEN METAL *CAN'T* HURT 'EM!

NON-BURN NON-WARP SLIP JACKETS





ARE NOT AFFECTED BY RUNOUTS or SPILL-OVERS

CMD Slip Jackets won't stick; they fit smoothly and strip *clean* from the mold.

Heavy corner irons 2″ x 2″ x ⅛″ and cross reinforcing irons 1″ x 1″ x ⅛″ bolted and arc-welded in place prevent warping.

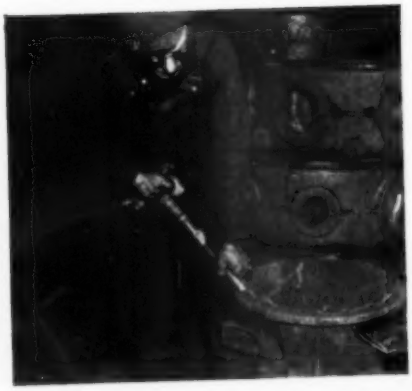
Write Today for Descriptive Circular!

On jackets up to 8″ deep, SINGLE angle irons are used.
On jackets over 8″ deep, DOUBLE angle irons are used.

CHICAGO MANUFACTURING & DISTRIBUTING CO.

Dept. F, 1928 West 46th Street **Chicago 9, Illinois**

FROM FAST HARD BLOW *TO RAPID LIGHT STROKE*



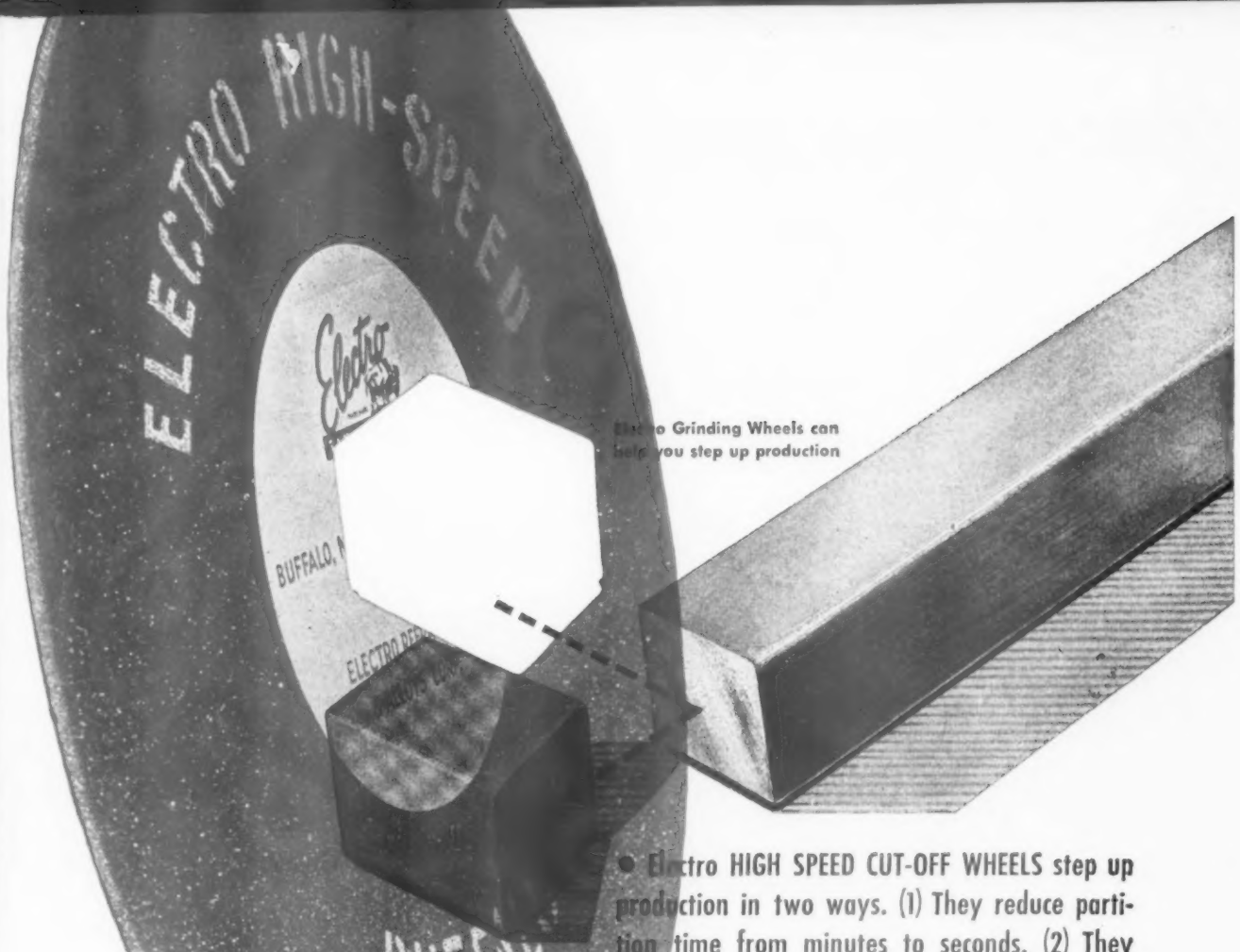
CP Chippers, of both Simplate and Ring Valve types, are made in a range of sizes to meet every requirement.

Efficient and economical sand ramming depends on the accuracy of control of the rammer blow. CP Sand Rammers are designed for instant acceleration from a fast, hard blow to an exceedingly rapid but light stroke, and vice versa. Floor and bench models in varied sizes for every foundry requirement.

CHICAGO PNEUMATIC TOOL COMPANY

General Offices: 8 East 44th Street, New York 17, N. Y.

PNEUMATIC TOOLS • AIR COMPRESSORS • ELECTRIC TOOLS • DIESEL ENGINES
ROCK DRILLS • HYDRAULIC TOOLS • VACUUM PUMPS • AVIATION ACCESSORIES



Electro Grinding Wheels can help you step up production

Electro HIGH SPEED cut-off wheels

• Electro HIGH SPEED CUT-OFF WHEELS step up production in two ways. (1) They reduce partition time from minutes to seconds. (2) They leave a fine finish on both sides of the cut.

These high efficiency cutters are possible only because of the scientific advances we have achieved with binders and the comparable technological advances we have made with grading and combining abrasive particles. Wheel truth and cutting effectiveness are so extraordinary that molecular disturbance adjacent to the narrow line of cutting action, makes no material change in the quality of the metals or ceramics upon which these Electro HIGH SPEED CUT-OFF WHEELS are used. Let us prove these facts in *your* plant on *your* work.

•

GET THIS NEW BOOK . . . *Every metal working and ceramic industries production executive should get a copy of our Grinding Wheel Manual 645. It explains abrasives in detail and all types of grinding wheels. Illustrations are from full-color photographs. It's FREE.*

Electro REFRACTORIES AND ALLOYS CORP.
344 DELAWARE AVE. • BUFFALO 2, N. Y.

West Coast Warehouse, Los Angeles

Electro SINCE 1910

Mfrs. • Crucibles • Cements • Stoppers Refractories • *High Speed* Grinding Wheels

K-429

Cast Iron

JACKETS

Are Best by Test

FREMONT MAGNESIUM FLASKS

ACCURATE.

STURDY...

LIGHT.....

BUILT FOR LONG SERVICE AND FAST PRODUCTION

GROOVLOCK

THE FOOL-PROOF PIN

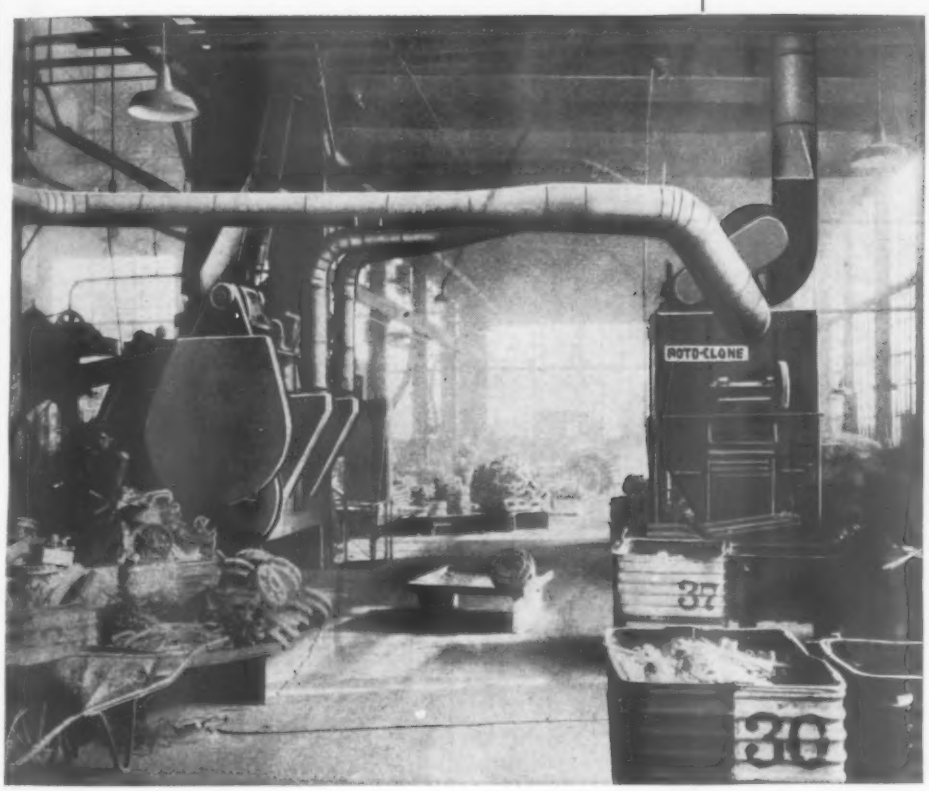
THE FREMONT FLASK CO.
Fremont, Ohio

ROTO CLONE

removes the Dust Storm

from abrasive cleaning

ABRASIVE cleaning by airless blasting has increased production—and also the dust problem. The same amount of dirt or scale is blasted from castings as by any other method except faster. Removal of the resulting heavy dust load is essential for efficient cleaning and desirable working conditions and experience has proved it can be done efficiently and economically with Roto-Clone Dust Control Equipment.



Pictured is an airless blasting operation equipped with a Type N Roto-Clone Hydro-Static Precipitator. Collection efficiency of this unit is extremely high because dust separation is obtained by a combination of centrifugal force and thorough scrubbing of the air by water sprays. The Type N requires a minimum of attention, exhausts a constant air volume for effective dust removal and eliminates all secondary dust problems by ejecting the collected material as a sludge for easy disposal.

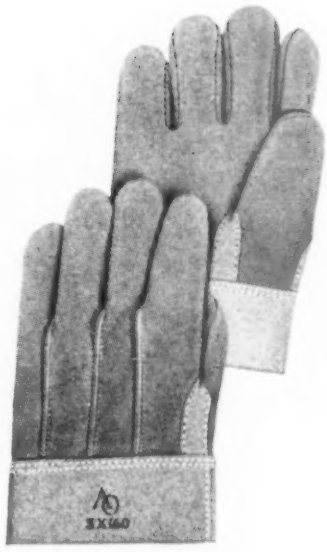
If you want the benefits of abrasive cleaning without the dangers of dust, write for Bulletin No. 270-A, describing this and other Roto-Clone applications in the foundry industry.

AMERICAN AIR FILTER CO., INC.
266 Central Ave., Louisville 8, Ky.
In Canada: Darling Bros. Ltd., Montreal, P. Q.

AAF

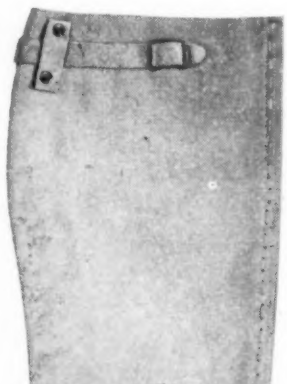
ROTO-CLONE
DUST CONTROL EQUIPMENT

in Safety Clothing means Protection with Comfort ... from Head to Toe



AO 5X160 ALL-PURPOSE GLOVE. You don't have to handle jobs with "kid gloves" when wearing these tough chrome-tanned products of split horsehide. They will wear up to seven times longer than ordinary cotton gloves. All seams are securely stitched to prevent pulling or splitting. Clute pattern. Reinforced leather strap around thumb. Ideal for warehouse work and handling rough stock.

AO 4901 CL LEGGING — the chrome-tanned cowhide answer to heat, sparks and hot metal splashes. Comfortable and flexible — with complete protection for lower leg, ankle and instep. Easily adjusted at top and under instep by snap fasteners. *One swift motion releases immediately.* Available in leather, asbestos or flame-resisting duck.



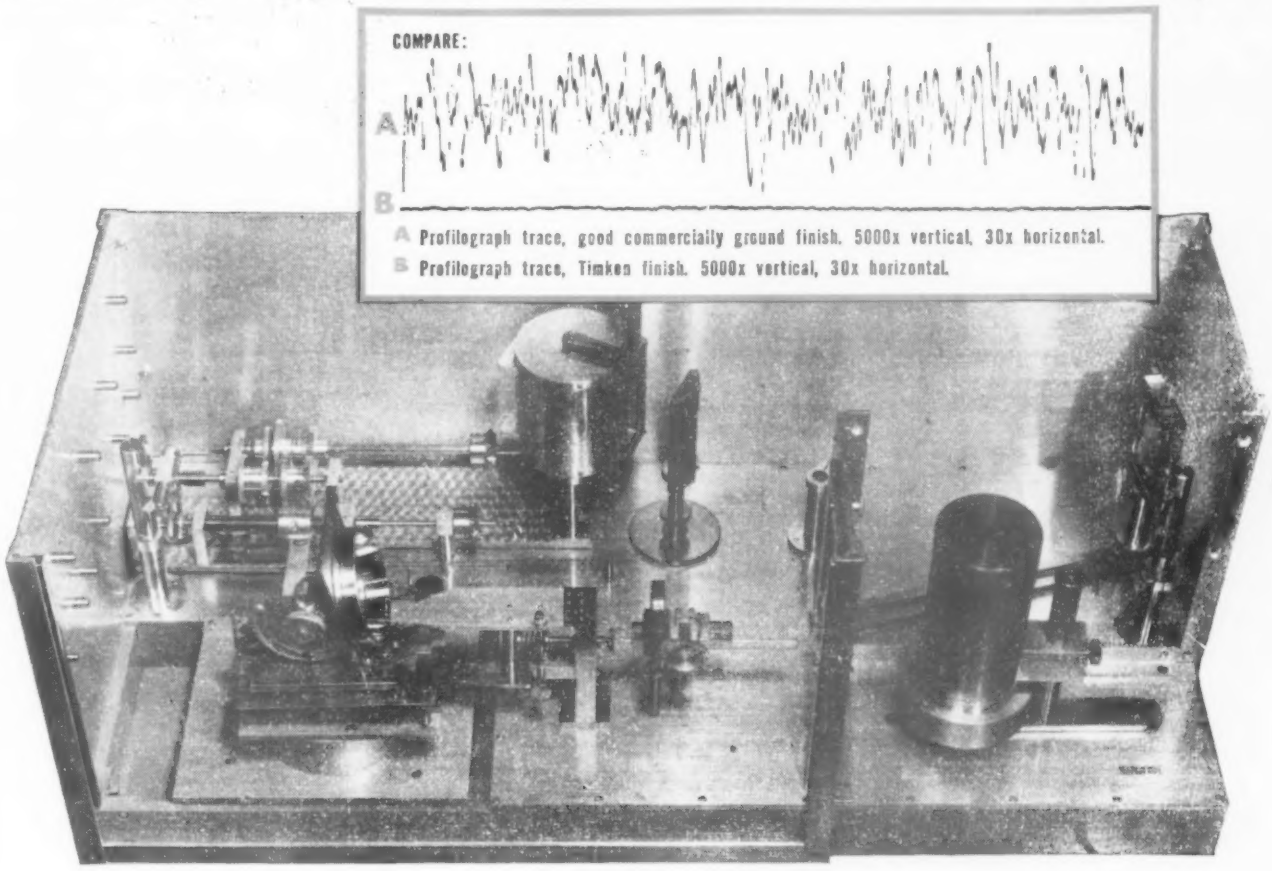
AO 4X144 SLEEVELET — Safeguard arms against cuts, abrasions and heat. Chrome-tanned split cowhide. Seam is double cotton stitched, reinforced with steel stitching. Draw strap holds securely — easy slide buckle adjustment. Recommended for heavy grinding, die casting, bench welding.

AO 2142 CL APRON defies many common foundry hazards. Rugged chrome leather construction protects the body from chest to knee against sparks, splashes, cuts and abrasions met in operations as varied as tending blast furnaces and grinding. Regular or split leg. Size 24" x 42". Other AO aprons available in leather, asbestos or flame-resisting duck in five sizes.

American Optical COMPANY *Safety Division*

SOUTHBRIDGE, MASSACHUSETTS • BRANCHES IN PRINCIPAL CITIES

Timken bearings make good foundry equipment better . . . here's one of the reasons why:


COMPARE:
A
B
A Profilograph trace, good commercially ground finish. 5000x vertical, 30x horizontal.
B Profilograph trace, Timken finish. 5000x vertical, 30x horizontal.

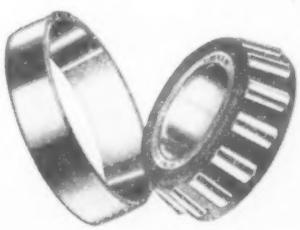
Answers the question— "How rough is smooth?"

ONE of the reasons Timken tapered roller bearings perform with such frictionless, wear-free ease is the amazingly smooth surface finish on the rolls and races —the finest known to modern bearing science.

Now, when you talk about finishes like this, you're talking about surface irregularities of only a few millionths of an inch—irregularities which are impossible to detect by any ordinary means. So, when Timken first began to develop this finish, one of the biggest obstacles was the absence of an accurate method of measuring the roughness of an apparently smooth surface.

The profilograph pictured above was the answer. Developed by Timken in 1928 and steadily improved since then, the profilograph determines surface irregularities to within one-millionth of an inch. Equipped with this measuring stick, Timken engineers were able to develop new finishing methods and machines, which have resulted in the microscopic surface accuracy of the Timken bearings you use today.

Every factor in the efficiency of a bearing is approached at Timken in this same scientific manner. For example, Timken makes its own steel to assure constant quality. And Timken is the acknowledged leader in: 1. advanced design; 2. precision manufacture; 3. rigid quality control; 4. special analysis steels. No wonder you can always be sure of uniformly top quality and performance in the Timken bearings you use. The Timken Roller Bearing Company, Canton 6, Ohio.



TIMKEN

("TIMKEN" TRADE-MARK REG. U.S. PAT. OFF.)

TAPERED ROLLER BEARINGS

NOT JUST A BALL ○ NOT JUST A ROLLER ▭ THE TIMKEN TAPERED ROLLER ▭ BEARING TAKES RADIAL ◫ AND THRUST →◫← LOADS OR ANY COMBINATION →✳←

NONE BETTER

MELTRITE

PIG IRON

Exactly What the Name Implies

More USED than Any Other
Merchant PIG IRON—
Such Preference Must Be Merited

PICKANDS MATHER & COMPANY

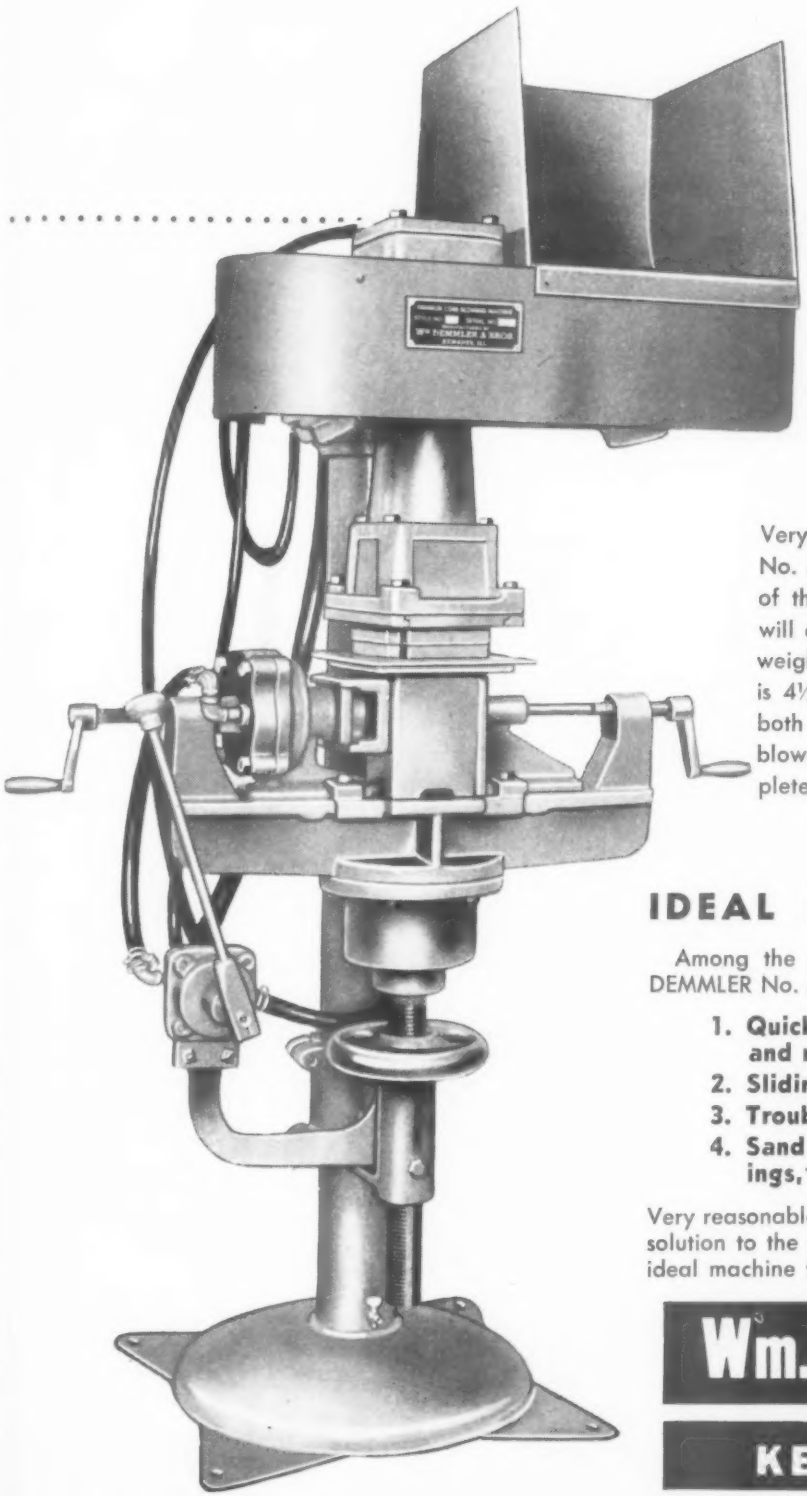
Cleveland • Chicago • Detroit • St. Louis
Erie • Duluth • Minneapolis • Toledo

P M

IRON ORE • PIG IRON • COAL • COKE

DEMMLER *Announces the new*

NO. 55



A FAST CORE BLOWER EVERY FOUNDRY NEEDS AND CAN AFFORD

Very similar in design to the now famous DEMMLER No. 50, the NEW No. 55 has 2 inches greater depth of throat for longer gang core boxes. The No. 55 will accommodate boxes 9 inches long—handle cores weighing up to 3 pounds. Sand magazine opening is 4½ by 9½ inches. A single hand valve operates both vertical and horizontal core box clamps and blows the core. Only 3 seconds required for complete cycle!

IDEAL FOR SHORT RUN JOBS

Among the many high quality features found on the new DEMMLER No. 55 are:

1. **Quick, easy adjustments for raising the table and moving chuck jaws**
2. **Sliding, quick change blow plates**
3. **Trouble-free diaphragm type blow valve**
4. **Sand magazine and carriage of aluminum castings, with ball bearing rollers**

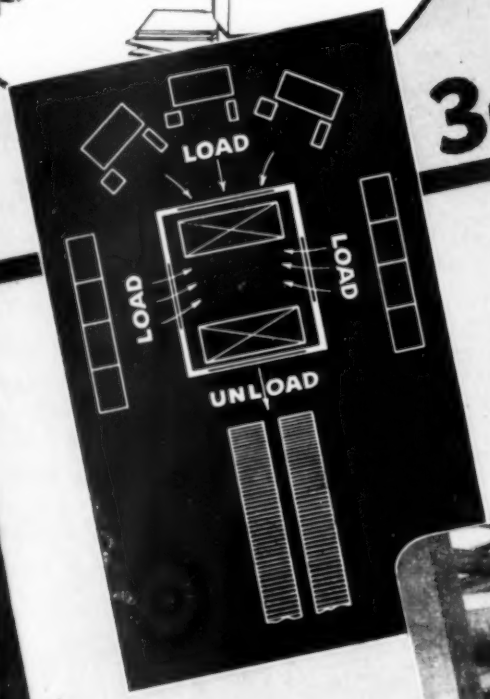
Very reasonable in price, the DEMMLER No. 55 is the economical solution to the rapid production of high quality small cores—an ideal machine for any foundry whether large or small.

Wm. Demmler & Bros.

KEWANEE, ILLINOIS

SEND FOR ILLUSTRATED SPECIFICATION SHEET

ONLY COLEMAN OFFER These



3-SIDE LOADING

Only the Patented Open Center makes possible the efficient grouping of coremakers around 3 sides of the Tower and increases loading accessibility up to 300% compared with ordinary vertical oven design.

COLEMAN TOWER OVENS in gray iron jobbing foundry. Many similar installations in malleable, steel, aluminum and magnesium foundries.

COLEMAN CORE and MOLD OVENS

The FOUNDRY Q
CLEVELAND 13 HI

BUILDERS OF COLEMAN ND

TOWER OVENS
EXCLUSIVE FEATURES

To get the most out of modern continuous baking with vertical core ovens, you must have the advantages offered by the exclusive features of Coleman Tower Ovens.

FAST LOADING. Patented Open Center makes them by far the fastest loading vertical ovens built.

PERFECT BAKING AT AMAZING SPEEDS. Perfect core baking eliminates rejects and make-overs.

LARGE LABOR SAVING. The efficient grouping of coremakers made possible by the Patented Open Center greatly increases man-power productivity and reduces indirect labor to a mere fraction.

RECUPERATIVE COOLING. Cores are cooled before reaching the unloading position and the recovered heat is used over again, resulting in *big fuel saving.*

BETTER WORKING CONDITIONS. With the cores cooled and "smoked-off" before unloading there are no acrid fumes or gases nor uncomfortable heat in the core department. Better conditions increase output.

LARGE OUTPUT FROM SMALL FLOOR SPACE. In Coleman Tower Ovens all the baking is done overhead, giving you large core-baking capacity from very little floor space.

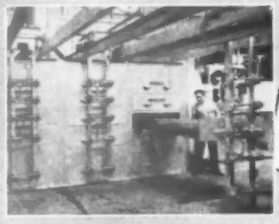
These and many other features are responsible for the wonderful record of performance of Coleman Tower Core Ovens in outstanding foundries producing all types of castings.

Coleman Ovens are also built in all conventional and special designs to meet every possible requirement in core baking and mold drying. Heating systems can be furnished to use the most economical fuel available in your locality—gas, oil, electricity, powdered coal, stoker coal, etc.

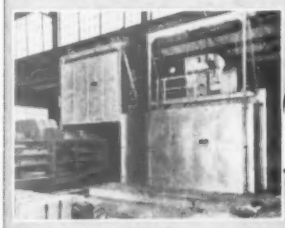
WORLD'S OLDEST AND LARGEST FOUNDRY OVEN SPECIALISTS. 9,000 SUCCESSFUL INSTALLATIONS.

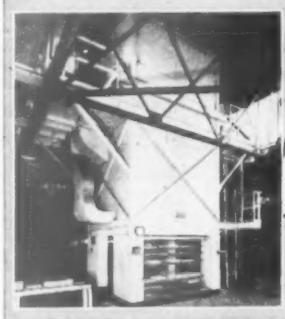
Write for Folio of Bulletins

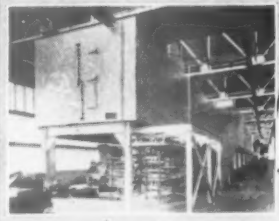
COLEMAN Portable Core Ovens

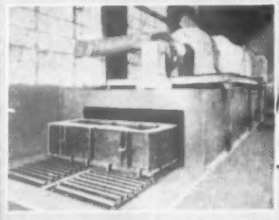

COLEMAN Rolling Drawer Ovens

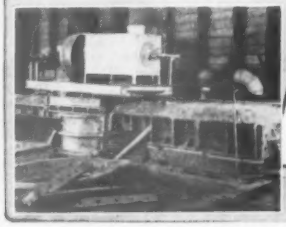
COLEMAN Transrack Ovens


COLEMAN Car Type Ovens


COLEMAN Tower Ovens


COLEMAN Horizontal Conveyor Ovens


COLEMAN Conveyor Mold Ovens

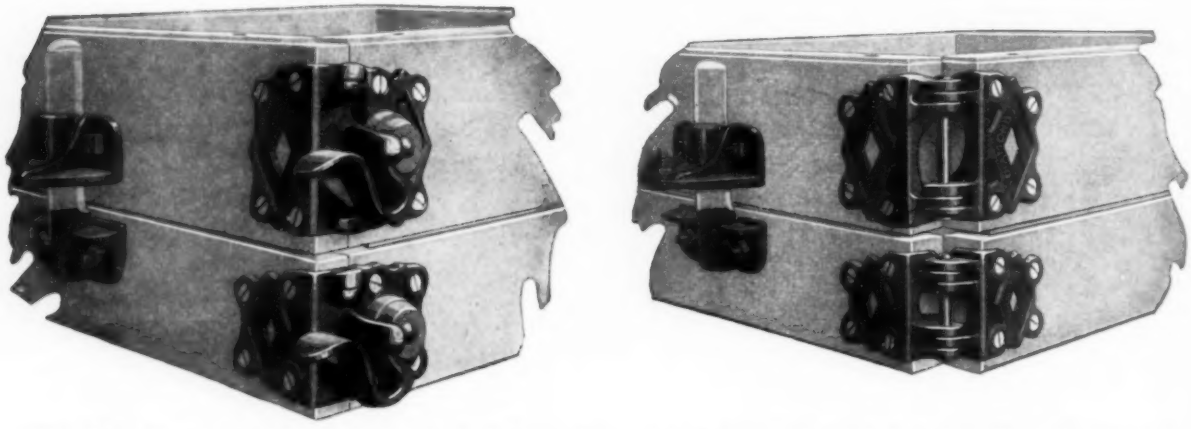

COLEMAN Portable Mold Dryers

QUIPMENT Company
HIO, U. S. A.
MEMBER
ND SWARTWOUT OVENS

ALL OUT FOR DIAMOND FLASKS

Another foundry modernizes to speed production and reduce costs with Diamond Flask Molding Equipment.

Diamond flasks are noted for their superior fittings. For instance, the latch fitting is self-compensating for wear. The tighter you draw it, the firmer the grip. Special cam is easily adjusted as extreme wear develops. Hinge construction includes careful milling of parts and interlocking feature which eliminates "play." In every way, you will find Diamond flasks precision-made for high production.



Our Flask Line is complete, of course, including all *special shapes* and a related line of *steel jackets.*

Originators of SNAP FLASKS

DIAMOND

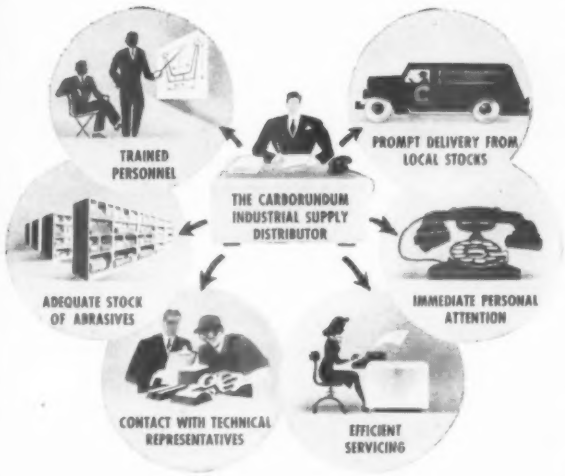
Telephone 2553 CLAMP AND FLASK COMPANY Richmond, Indiana

Designers of* CORE PLATES, JACKETS, BANDS, FLASKS *since 1889

A BUYING GUIDE FOR ABRASIVES

POINT No. 6

LOCAL DISTRIBUTOR SERVICE



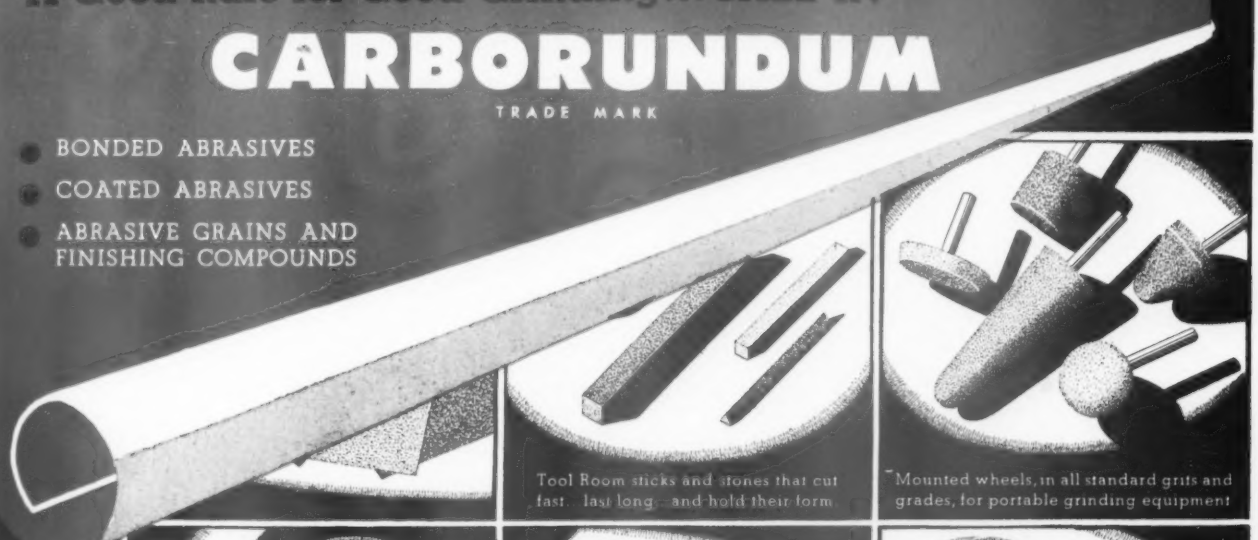
With progressive purchasing methods dictating improved efficiency of supply, the services of your CARBORUNDUM distributor assume increased importance. Prompt delivery of standard wheels, coated abrasives, sticks and stones, and grains by CARBORUNDUM is assured from large and varied stocks conveniently located nearby. Factory inventories of these items can be safely and economically reduced. More efficient use of abrasives is promoted through a local staff, trained by CARBORUNDUM, and familiar with varied applications. They are informed on latest developments and have access to CARBORUNDUM representatives when the problem is too difficult or unusual. Intelligent handling and efficient office routine is also pointed to by some customers who prefer the personal consideration and attention rendered by these modern distribution units. These services account in part for the increasing preference for products by CARBORUNDUM. The Carborundum Company, Niagara Falls, New York.

A Good Rule for Good Grinding...CALL IN

CARBORUNDUM

TRADE MARK

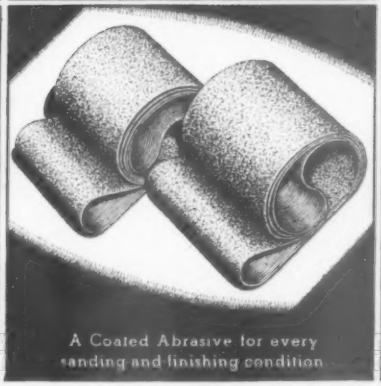
- BONDED ABRASIVES
- COATED ABRASIVES
- ABRASIVE GRAINS AND FINISHING COMPOUNDS



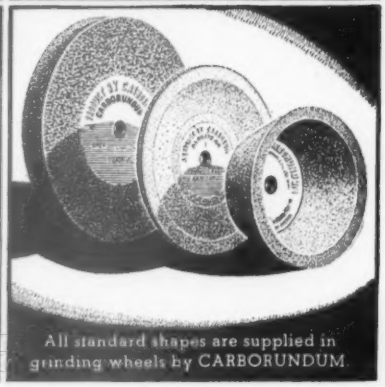
Tool Room sticks and stones that cut fast... last long... and hold their form

Mounted wheels, in all standard grits and grades, for portable grinding equipment

Cutting-Off Wheels... the modern tool for faster, less costly, more finished cuts



A Coated Abrasive for every sanding and finishing condition



All standard shapes are supplied in grinding wheels by CARBORUNDUM

"Carborundum" is a registered trademark which indicates manufacture by The Carborundum Company.

MOLDED TO *Perfection!*

SMITH L-O CORE OIL . . . THE *ONLY* CORE OIL PROCESSED BY THE DOW-THERME METHOD!

That's a fact. Smith L-O Core Oil is the *only* core oil produced by the patented Dow-Therme method of heat control. This modern system — which replaces conventional direct fire methods — provides greater uniformity and homogeneity of the mix . . . enables us to supply you with a core oil superior in strength, decidedly faster in drying qualities, and more controllable on the job.

For greater savings in time, effort, and money . . . for consistently better performance from make-up to finished casting, depend on Smith L-O Core Oil with full confidence. Order your requirements from the Smith representative nearest you.

Smith L-O *Core Oil*

WAREHOUSE STOCKS AVAILABLE
In The Following Cities

- Foundry Service Co. Birmingham, Alabama
- E. R. Frost Co. Minneapolis, Minnesota
- Hill & Griffith, Chicago, Illinois
- Frank C. Maley Detroit, Michigan
- William F. Rose, Tomkins Tidewater Terminal South Kearny, New Jersey
- Southwest Foundry Supply Co. Houston 7, Texas
- Malcolm G. Stevens Arlington, Mass.
- M. W. Warren Coke Co. St. Louis, Missouri
- Western Foundry Sand Co. Seattle, Washington
- Western Industrial Supply Co. Portland 14, Oregon

Smith L-O *Core Oil*

CORE WASH ROD DIP LIQUID PARTING

SMITH OIL & REFINING CO.
INDUSTRIAL OILS DIVISION . . . ROCKFORD, ILLINOIS

Tomorrow... *you can expect other useful alloy developments from ELECTROMET*

Today ... *ELECTROMET alloys reflect over 40 years of production experience. Achievements during the last 25 years include—*

1920	Silicon Metal
1921	Chromium Metal
1922	Manganese Metal
1923	12-15% Zirconium Alloy
1925	Calcium-Silicon
1926	Low-Carbon Ferrochrome (Max. 0.10% Carbon)
1927	Silicomanganese
1928	Low-Carbon Ferrochrome (Max. 0.06% Carbon) 35-40% Zirconium Alloy
1929	Calcium-Manganese-Silicon
1930	Silicon Briquets
1931	Chromium Briquets Ferromanganese Briquets Silicomanganese Briquets
1934	Ferroboron Nitrogen-Bearing Ferrochrome
1935	Ferrocolumbium Nickel-Boron Barium-Silicon Silicon-Titanium
1936	Calcium Metal "Silcaz" Alloy
1937	Low-Carbon Ferrochrome (Max. 0.03% Carbon) Purified Silicon Special Graphitizer
1938	Electrolytic Chromium
1939	Ferrotitanium
1940	"SM" Ferrochrome
1941	"SMZ" Alloy
1942	Distilled Calcium Metal
1943	"CMSZ" Mix Aluminum-Titanium
1944	"SZT" Alloy Calcium Boride
1945	Low-Phosphorus Ferromanganese Molybdenum Metal (85%)
1946	Aluminum-Zirconium

Produced by

ELECTRO METALLURGICAL COMPANY

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30 East 42nd Street New York 17, N. Y.

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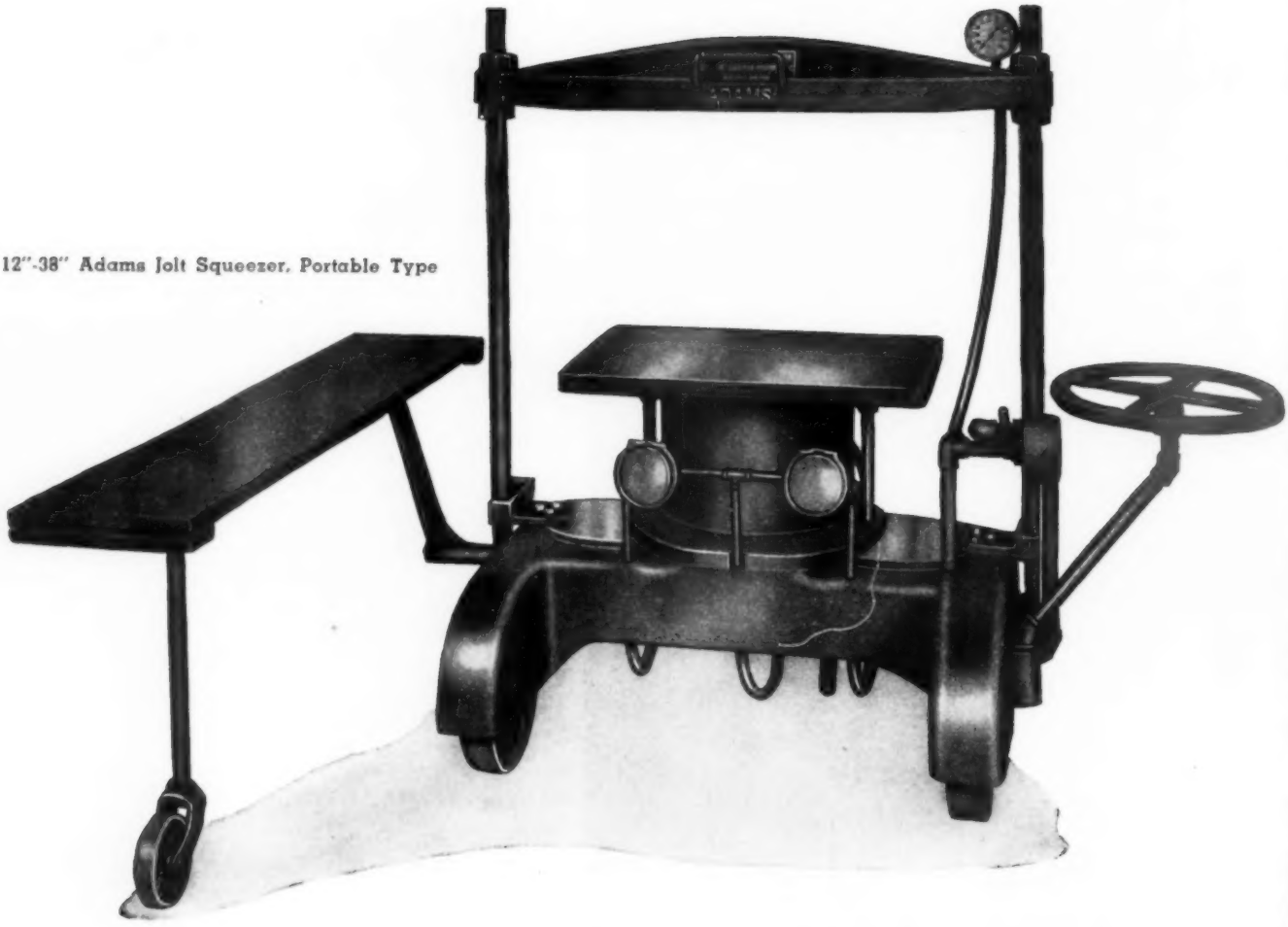
Electromet

TRADE-MARK

Ferro-Alloys & Metals



The 12"-38" Adams Jolt Squeezer, Portable Type

Adams Molding Machines give you these 10 in

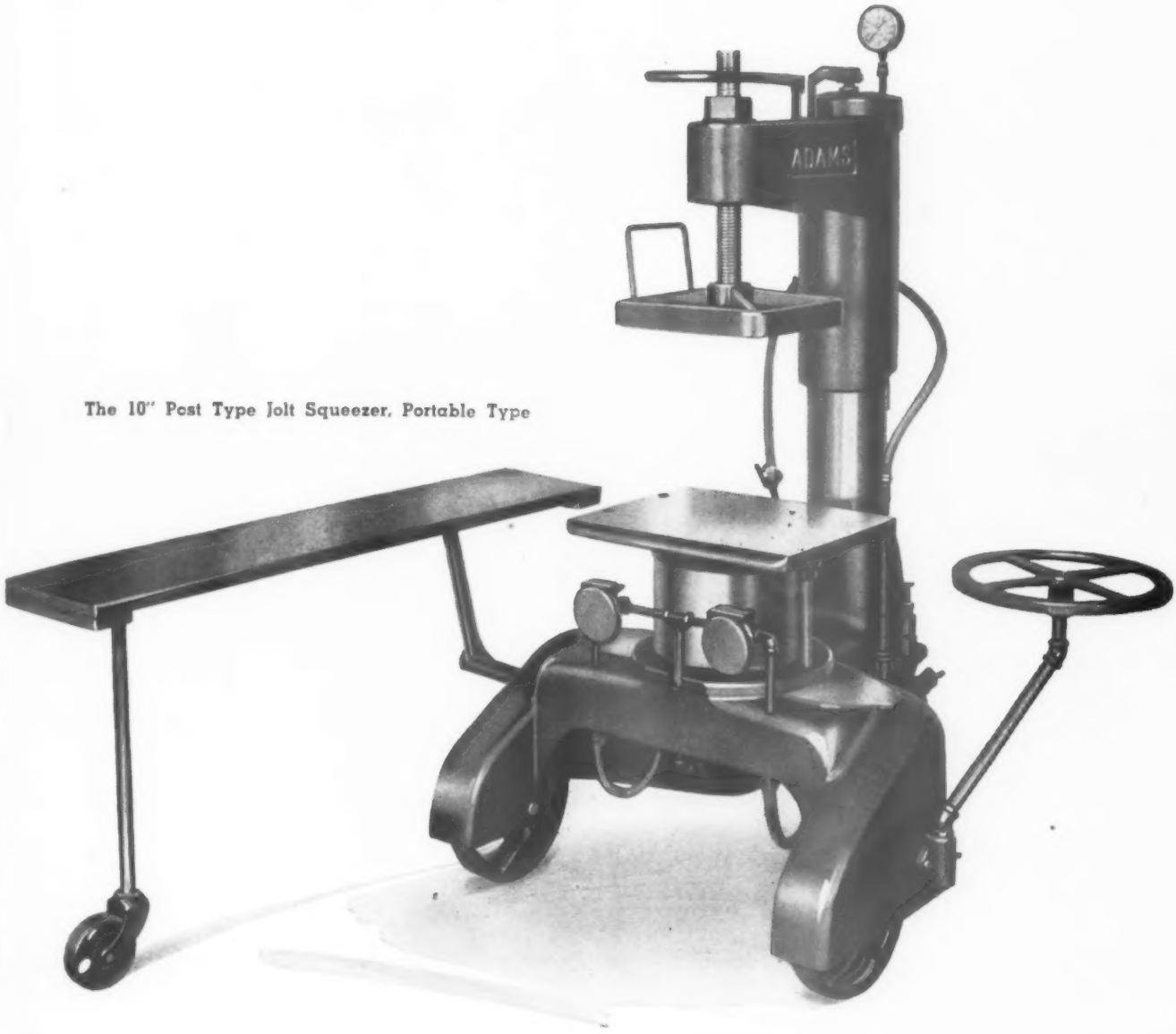
The complete **ADAMS** *line of foundry equipment:*

Side Rod Jolt Squeezers • Post Type Jolt Squeezers • Hand Squeezers • Knee Valves • Table Rappers • Pattern Plate Vibrators • Tubular Sprue Cutters • Cherry Snap Flasks • Cherry Slip Flasks • Aluminum Slip Flasks • Easy-Off Flasks • Cherry Presser Boards • Wood Bottom Boards • Steel Bottom Plates • Steel Jackets • Aluminum Jackets • Cast Iron Jackets • Steel Bands • Steel Upsets • Cherry Upsets • Aluminum Upsets

THE ADAMS

DUBUQUE,

MOLDING MACHINES . . . . . FLASK



The 10" Post Type Jolt Squeezer, Portable Type

important advantages..

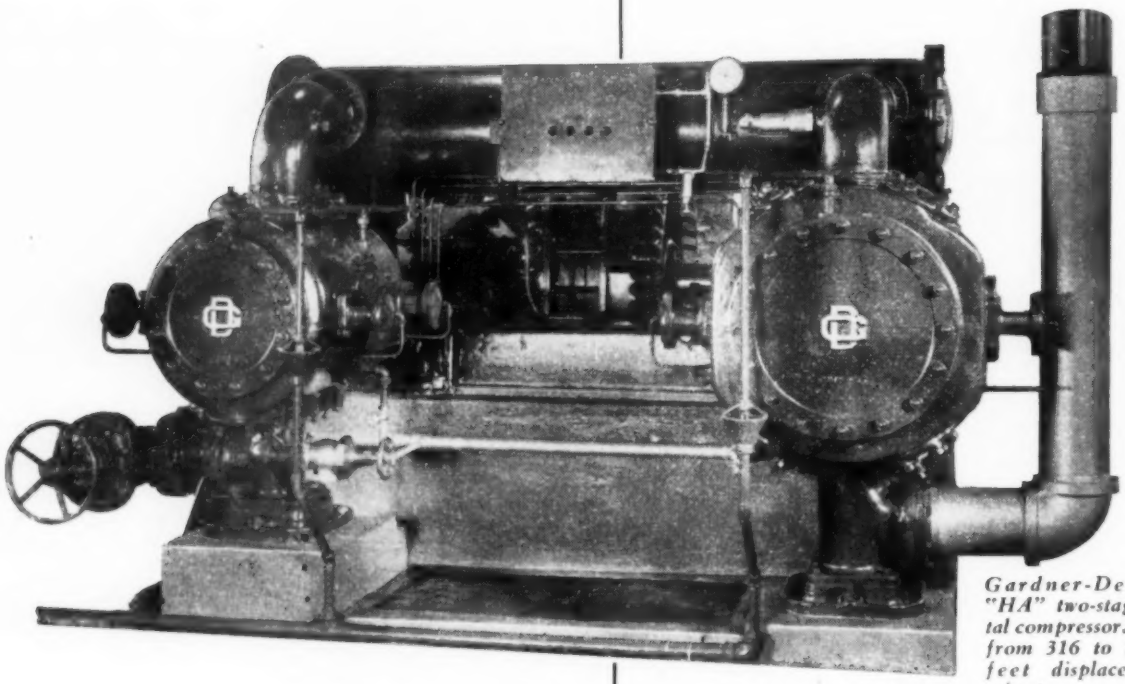
1. Valveless jolt mechanism—nothing to get out of order.
2. Adjustable knee valves for jolt and vibrator control leaves hands free.
3. Disc type operating valve assures easy control of squeezing operation.
4. Adams automatic oiler lubricates thoroughly and reduces maintenance.
5. Adams pressure regulator provides positive control up to line pressure.
6. Large cylinder bearing surface maintains alignment and minimizes wear.
7. Rust-proofed stop rods, side rods and adjusting nuts.
8. Completely protected against entry of sand and dust.
9. Easy rolling ball bearing wheels on portable models.
10. Standardized—all parts are interchangeable.

COMPANY

IOWA, U.S.A.

EQUIPMENT . . . . . Established 1883

"to what do you attribute
YOUR LONG LIFE?"



Gardner-Denver Class "HA" two-stage horizontal compressor. Capacities from 316 to 2012 cubic feet displacement per minute.

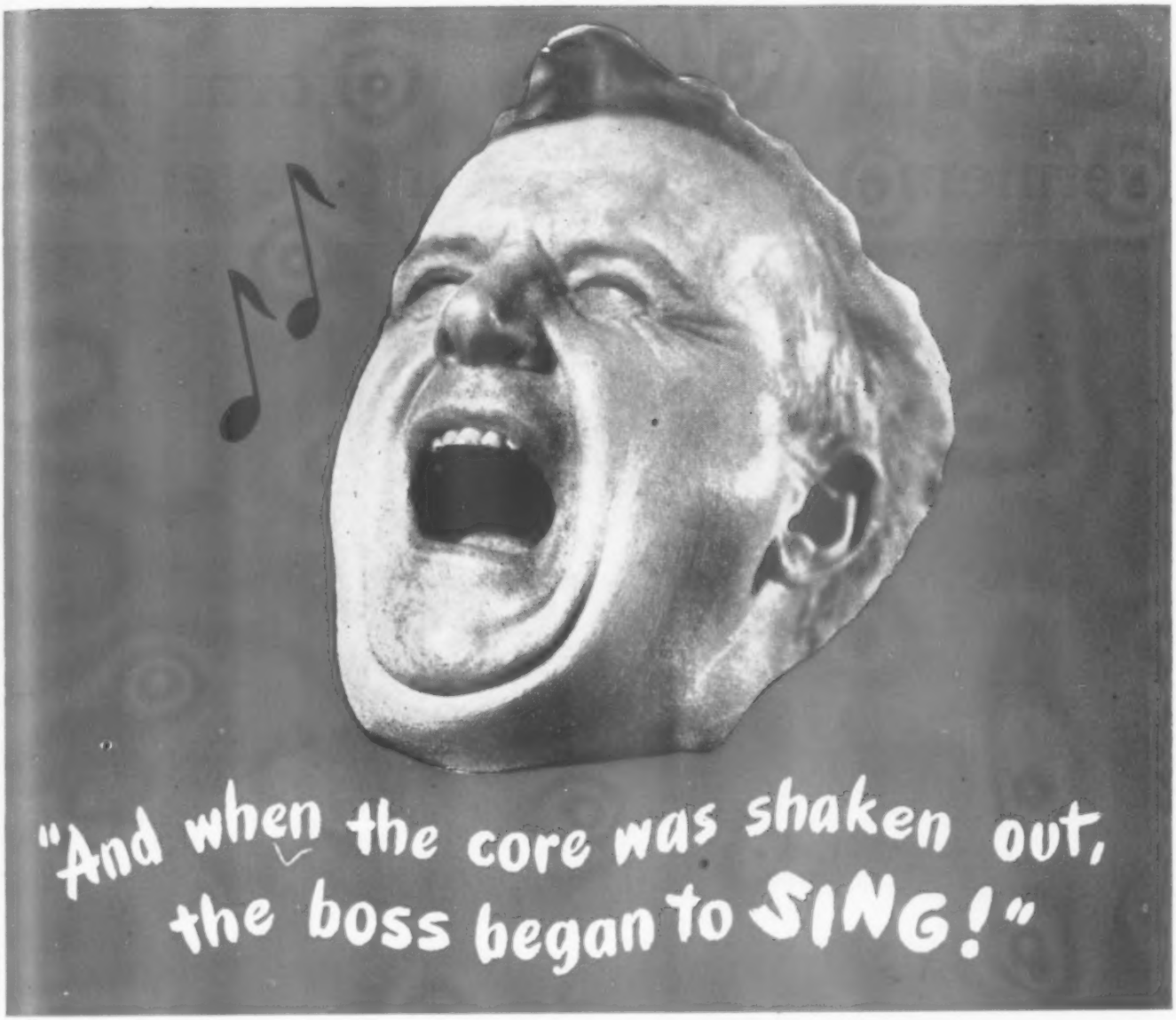
WHY do Gardner-Denver "HA" Horizontal Compressors last so long — maintaining their high efficiency after years of service? One reason is that in these compressors, shaft friction and wear have practically been eliminated. Timken roller main bearings provide permanent rigidity with freedom from bearing vibration, pounding and side thrust. Bearings will run indefinitely without adjustment, but when take-up is necessary, they may easily be adjusted with assurance that the main shaft will be in line. Here are other reasons why you'll want a Gardner-Denver "HA" in your plant—

- *Duo-Plate cushioned valves for high delivery capacity — high compression efficiency and lowest power consumption.*
- *Air cylinders designed for highest volumetric efficiency and lowest horsepower requirements.*
- *Large water jacket areas for cooler running . . . lower discharge temperatures and lubricating economy.*
- *Heavy-duty massive main frames, heavily ribbed and reinforced for maximum strength and rigidity.*
- *Five-step capacity control regulates air output to suit your air needs.*

For complete information, write
Gardner-Denver Company, Quincy, Illinois.

USE COMPRESSED AIR FOR SAFETY CONVENIENCE FLEXIBILITY

GARDNER-DENVER
SINCE 1859



"NEVER saw cores behave so well before. From the time they were nothing but a pile of mix, their behavior has brought joy to the most critical coremaker. Plenty of green strength; better permeability; no sticking; and they collapse like a tired pup on a pillow. Look at these castings! They're smooth and sharp. The whole batch is dog-gone near perfect. And, believe me, that's the way to make core room costs toe the mark.

"We're using Krause Cereal Binders in our coremaking. Some like the lightweight — *TRUSCOR*, the Krause people call it; some like the heavyweight — *AMERIKOR*, by name. My core making troubles flew right out of the window when we started using Krause cereal binders, so I'll pass along a tip — make your choice either lightweight or heavyweight — but just be sure it's a Krause Cereal Binder."

We can't add much more to the boss' story except to remind you that on your next order, ask for Krause cereal binders — *TRUSCOR* for lightweight; *AMERIKOR* for heavyweight. And if you have a core problem that needs solving, phone, write or wire us the details. We'll be glad to help you.

CHAS. A. KRAUSE MILLING CO., Milwaukee 1, Wis. • *World's Largest Millers of Dry Corn*

CEREAL BINDERS

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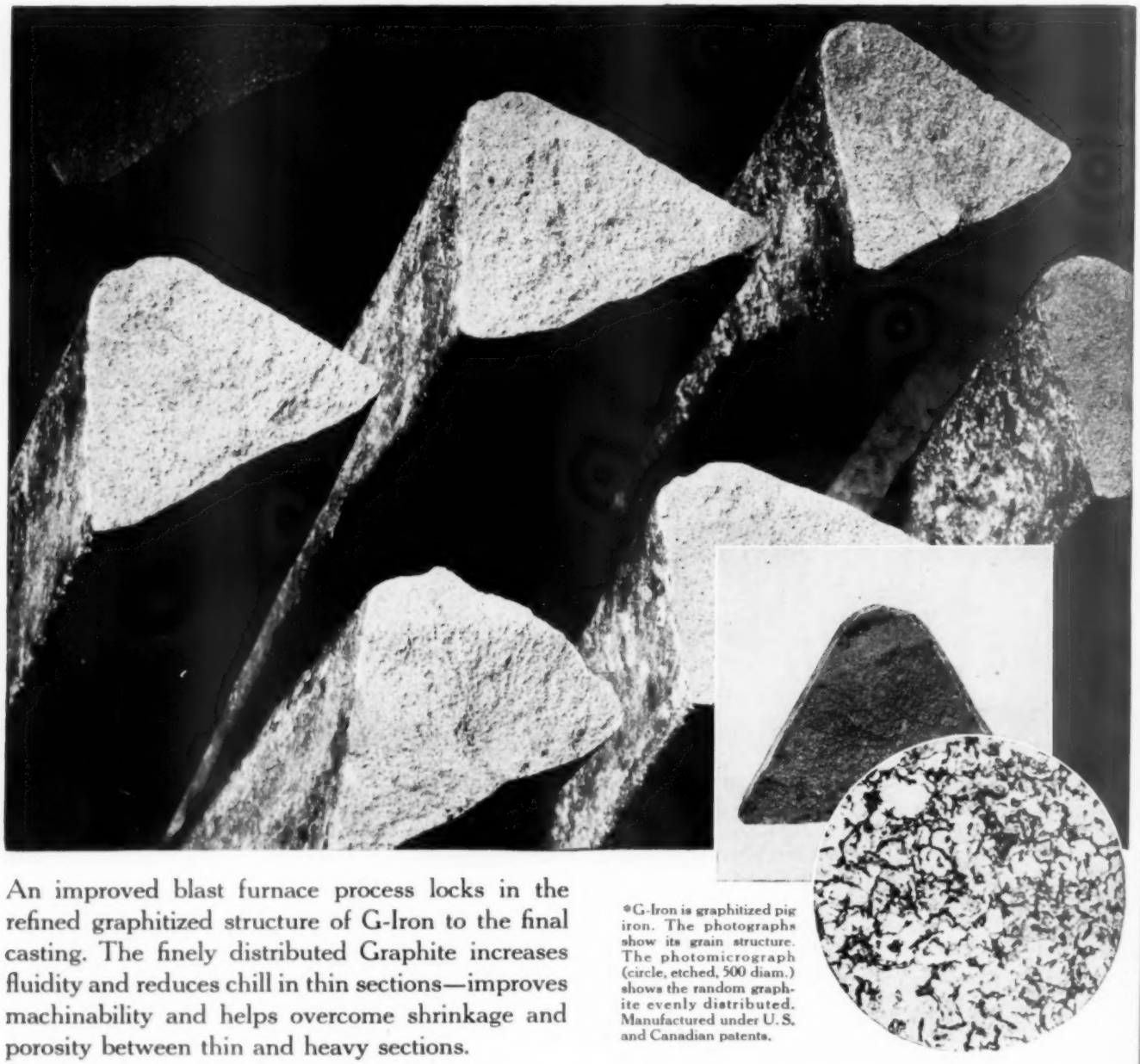
Pacific Graphite Works, Oakland 8, Calif.
Porter-Warner Chattanooga 2, Tenn.
Smith-Sharpe Co., Minneapolis 14, Minn.
Frederic B. Stevens, Inc., Buffalo 12, N. Y.
Frederic B. Stevens, Inc., Cleveland 14, Ohio
Frederic B. Stevens, Inc., Detroit 26, Mich.
Western Industrial Supply Co. 208 S. E. Hawthorne Blvd. Portland 14, Oregon

G-IRON'S* uniform grain refinement is locked into every pig



An improved blast furnace process locks in the refined graphitized structure of G-Iron to the final casting. The finely distributed Graphite increases fluidity and reduces chill in thin sections—improves machinability and helps overcome shrinkage and porosity between thin and heavy sections.

*G-Iron is graphitized pig iron. The photographs show its grain structure. The photomicrograph (circle, etched, 500 diam.) shows the random graphite evenly distributed. Manufactured under U. S. and Canadian patents.

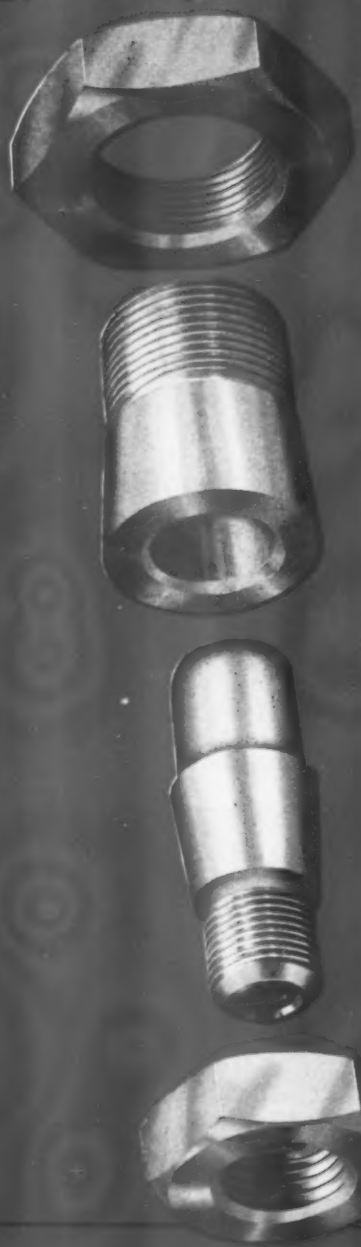
TONAWANDA for sound Castings

TONAWANDA IRON CORPORATION

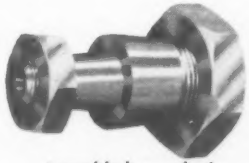
NORTH TONAWANDA, N. Y.

Division of American Radiator & Standard Sanitary corporation

Get perfect Cope and Drag register — better castings — with UNIVERSAL FLASK PINS and BUSHINGS



Only when cope and drag are perfectly lined up do you get the perfectly formed sand molds necessary to turn out true castings—and you can depend on perfect register of cope and drag once you accurately install Universal Standardized Flask Pins and Bushings. These modern accessories to good foundry practice are precision made, hardened, and ground for lasting accuracy. They anchor firmly with self-locking nuts to provide the positive stability vital to true register. Universal Standardized Flask Pins and Bushings are available for immediate delivery in several sizes of round, elongated, press fit and other standard types for use in cast iron, steel, and aluminum flasks. The pins and bushings illustrated are primarily for use in aluminum or magnesium flasks. Special types and sizes made to order. Write for complete information, and give us particulars of your requirements so we may make specific recommendations.

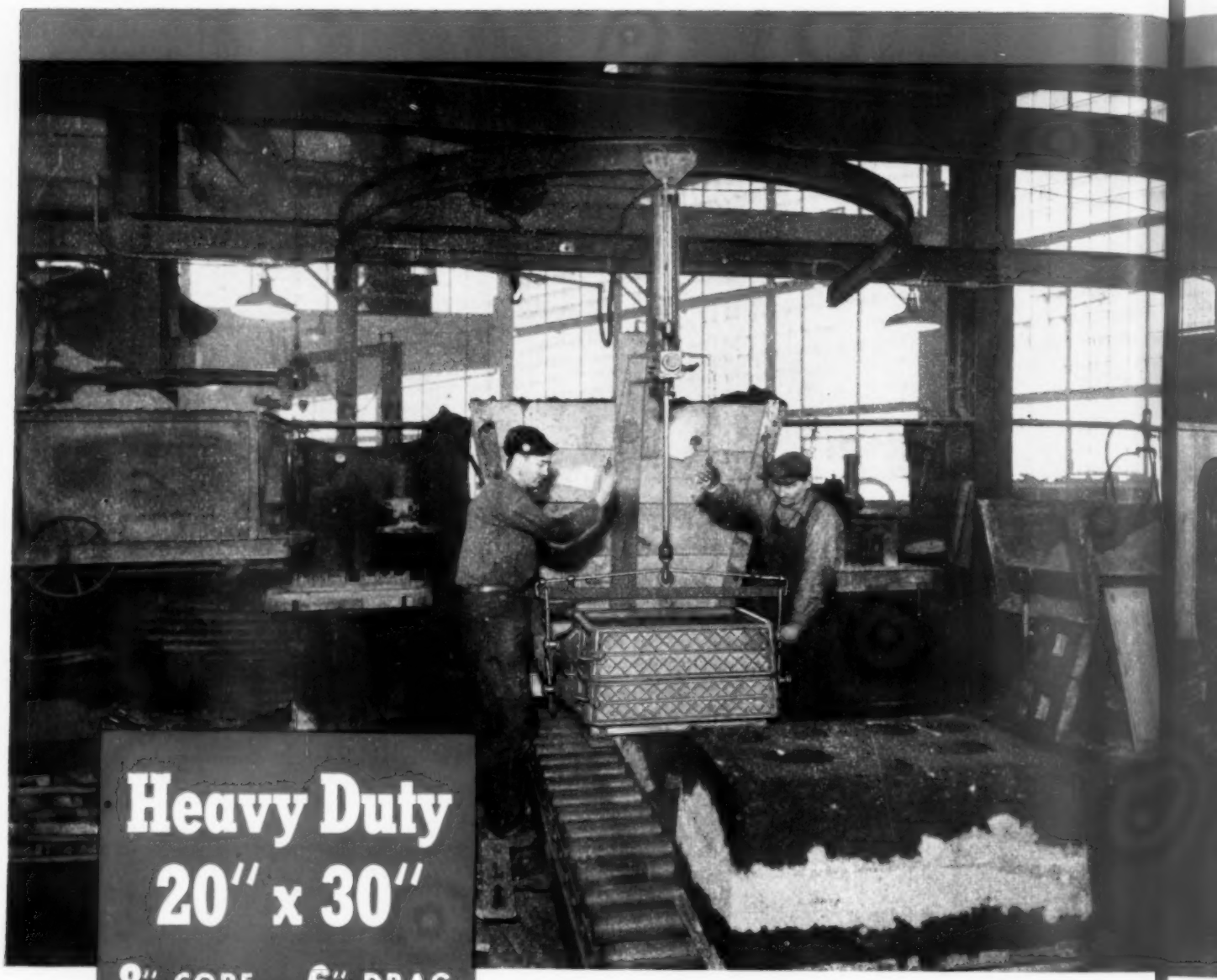


Assembled round pin and bushing.

Assembled octagon pin and elongated bushing.

Explosion view of octagon pin and elongated bushing.

UNIVERSAL ENGINEERING COMPANY • FRANKENMUTH, MICHIGAN



Heavy Duty
20″ x 30″
8″ COPE 6″ DRAG

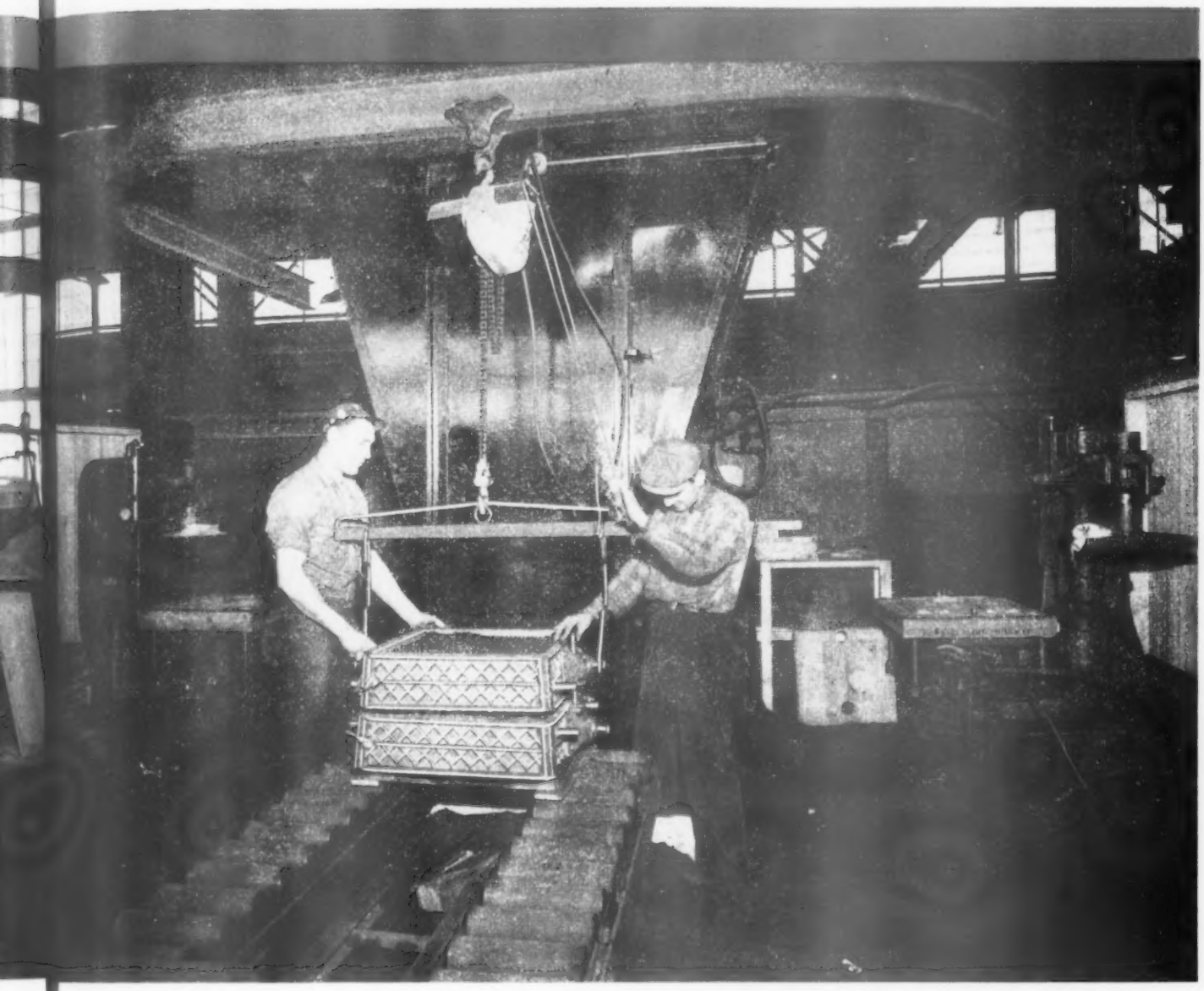
Fully protected by U. S. and Foreign Patents. Other Patents Pending.

HINES ALUMINUM "POP-OFF" FLASKS

EXCLUSIVE BUILDERS OF FLASKS AND JACKETS

THE HINES

3431 WEST 140th ST.



★ **Built to stand the gaff of big 16" jolt squeezers.**

★ **Weight is no problem here...the hoists do the lifting.**

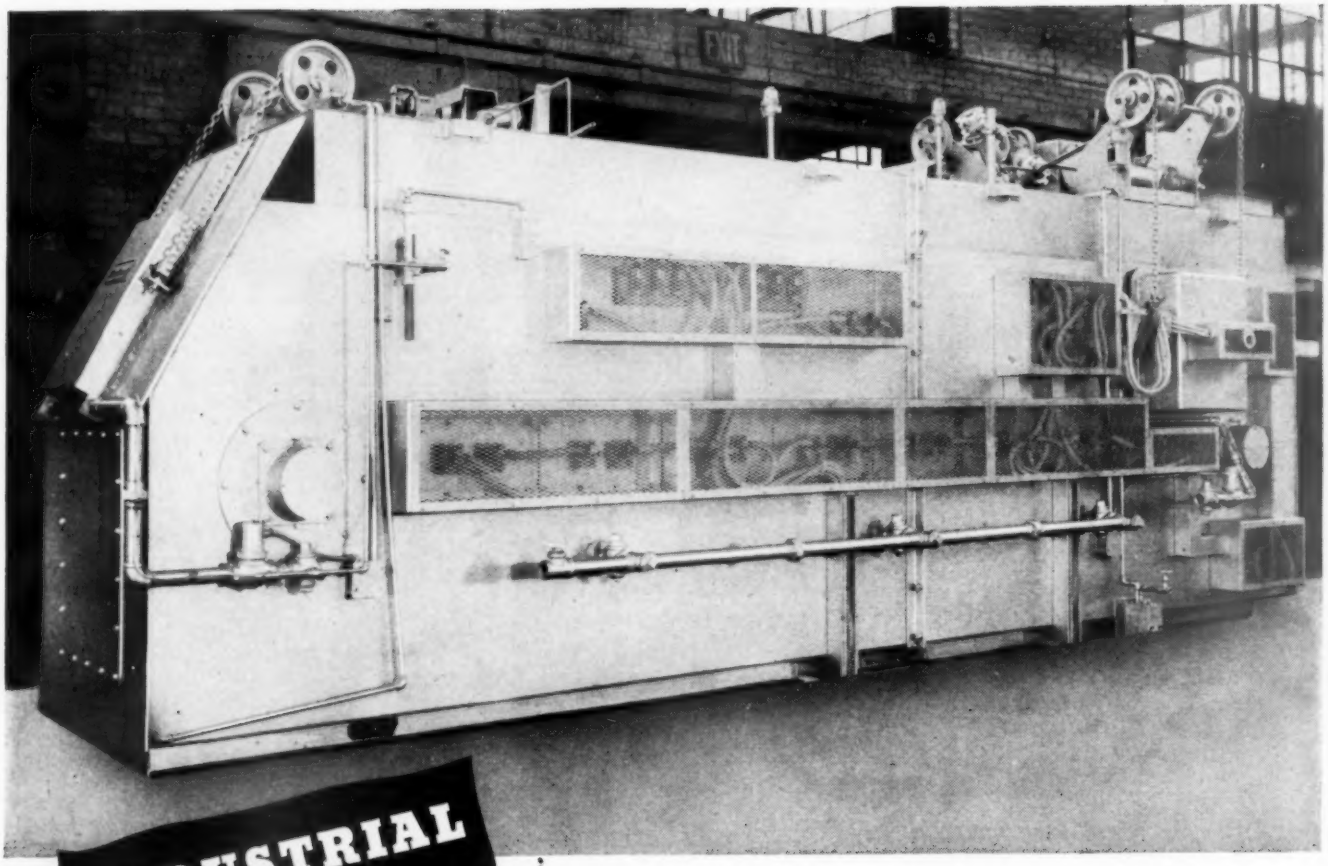
★ **Lighter weight flasks would never hold up on this job.**

HINES
POP-OFF
FLASK

FOR OVER TWENTY-FIVE YEARS

S FLASK CO.

CLEVELAND 11, OHIO



INDUSTRIAL FURNACES and OVENS

10,000 SEPARATE ITEMS

4,000 DIFFERENT SPECIFICATIONS

It is likely that the Heat Treating Furnace or Oven you need is included in this huge inventory. Let WAA find it for you—quickly, and with a minimum of effort on your part.

HERE'S WHAT YOU DO—

- ***. . . Determine your requirements.***
- ***. . . Fill in the "Specification Tear Sheet" in the back of the WAA booklet pictured at left.***
- ***. . . Send it to the War Assets Administration—Washington, D. C.***

WAA will then carefully screen its inventory to find the furnace or oven you specify, and will arrange for inspection before purchase. It's as easy as that!

ALSO AVAILABLE

TOCCO Heat Treating Furnaces. Send to your nearest Regional Office or Customer Service Center for complete listing of all Tocco Furnaces now in inventory.

If you have not received your copy of this valuable new WAA booklet, write immediately to the address below requesting a copy.

OFFICE OF GENERAL DISPOSAL

WAR ASSETS ADMINISTRATION

GOVERNMENT WAA SURPLUS

Offices located at: Atlanta • Birmingham • Boston • Charlotte • Chicago Cincinnati • Cleveland • Denver • Detroit • Grand Prairie, Tex. • Helena Houston • Jacksonville • Kansas City, Mo. • Little Rock • Los Angeles • Louisville • Minneapolis Nashville • New Orleans • New York • Omaha • Philadelphia • Portland, Ore. • Richmond St. Louis • Salt Lake City • San Antonio • San Francisco • Seattle • Spokane • Tulsa

WAR ASSETS ADMINISTRATION
General Industrial Equipment Division
Washington 25, D.C.

1211

CENTRAL DEWATERING is a Plus Value in a SCHNEIBLE DUST CONTROL SYSTEM

Schneible Dewatering Tank at large automotive production foundry. Note the volume of sludge, which once was dust.

Only one dewatering installation is required for handling all contamination collected by a Schneible system, regardless of the number of Schneible Multi-Wash Collectors employed to thoroughly remove dust and fumes from the air.

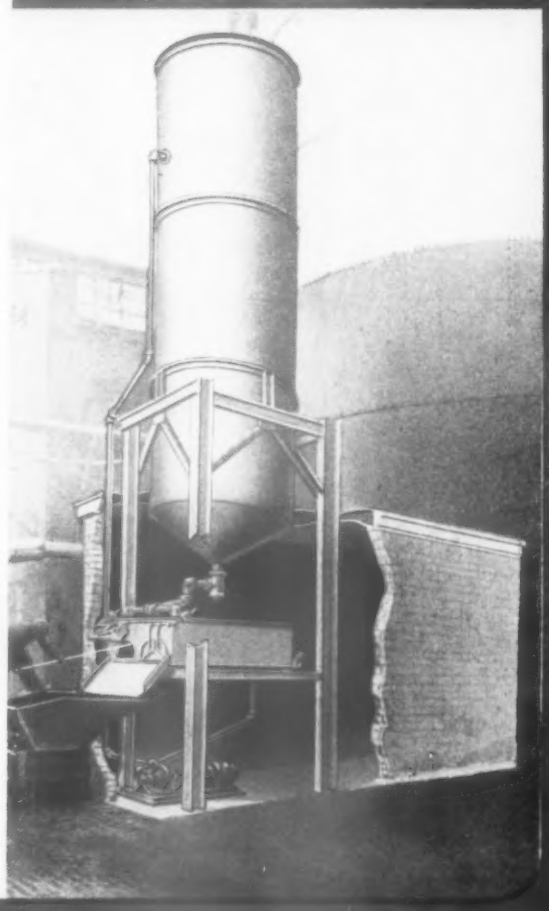
Schneible Dewatering Tanks—available in many standard models and sizes—provide an effective and economical means for settling the solids out of the water (or other liquid) and draining the water from the sludge by gravity for repeated use in the collectors.

The sludge permits much easier removal and disposal than a mass of dust. The Schneible Wet Method eliminates the purpose-defeating spread of dust. That's one of the reasons why so many foundries have installed Schneible Dust and Fume Control Systems.

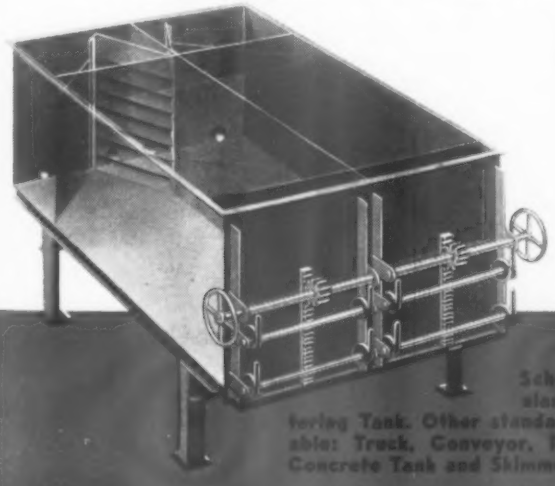
Schneible Central Dewatering Systems also serve to handle cupola fly ash collectors, cupola slag quench, core knockout refuse sluicing, and waste material disposal.

Send for new bulletin, "Schneible in the Foundry."

CLAUDE B. SCHNEIBLE CO.
2827 Twenty-Fifth St., Detroit 16, Mich.
Engineering Representatives in Principal Cities



Disposal of collected dust, as sludge, is an easy task at this nonferrous foundry. Schneible Multi-Wash Collector is also shown.

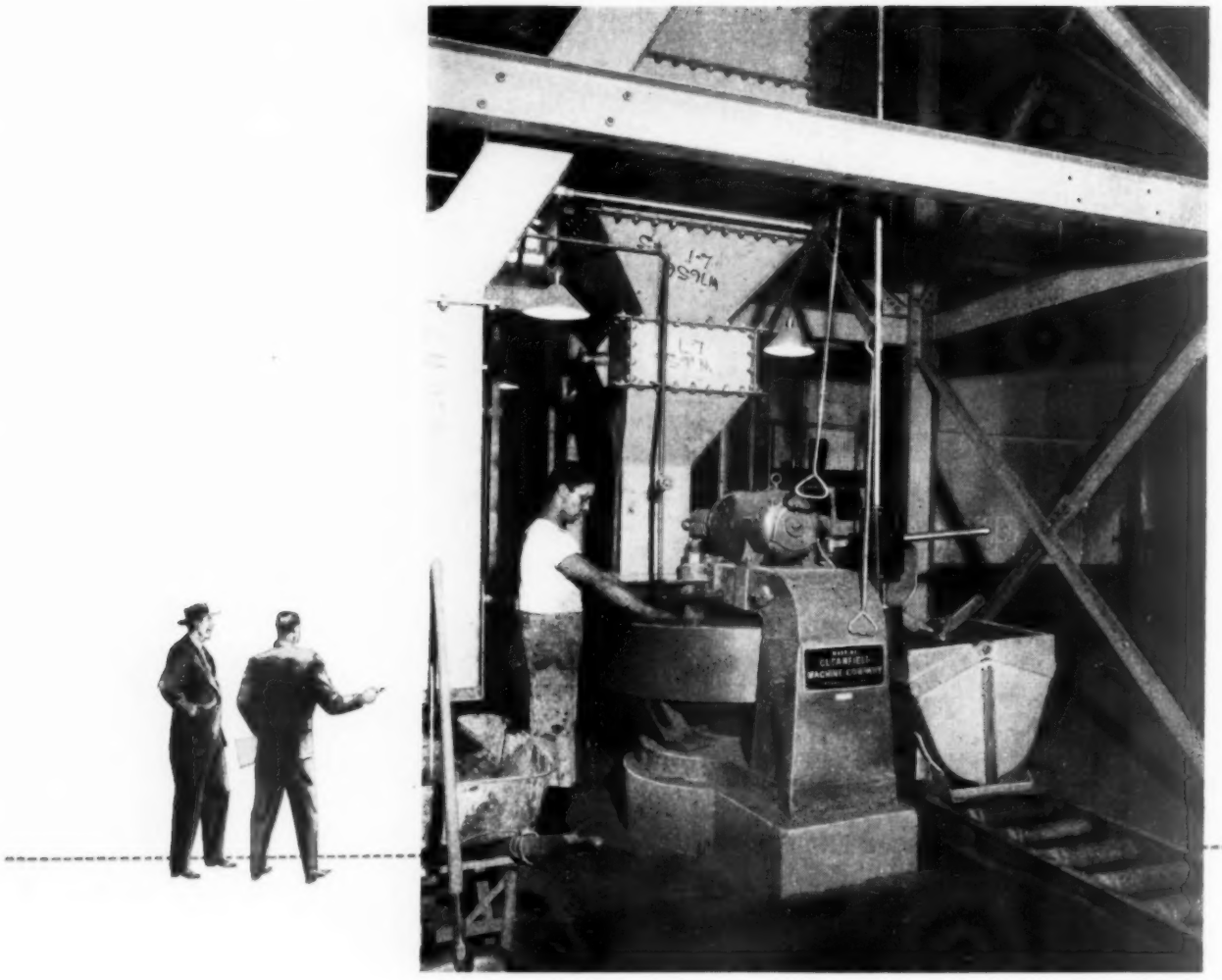


Schneible Rectangular Type Dewatering Tank. Other standard types available: Truck, Conveyor, Railroad Track, Concrete Tank and Skimmer.

MANUFACTURERS' ASSOCIATION, INC. FOUNDRY EQUIPMENT

SCHNEIBLE

LIQUID-VAPOR INTIMATE CONTACT EQUIPMENT for DUST COLLECTION ABSORPTION CONDENSATION AND TEMPERATURE REDUCTION



"all around" sand preparation

with a CLEARFIELD MIXER

★ The Clearfield Mixer combines in one compact and efficient machine a complete sand preparing unit for mixing, tempering and aerating. Every instant of operation is effective. The result is a combination of speed and thoroughness unobtainable in any other type of mixer. While retaining the batch principle which is essential to thorough tempering and the development of high bond strength, the Clearfield achieves these results so rapidly that it may be incorporated without difficulty in sand handling systems requiring continuous delivery of sand.

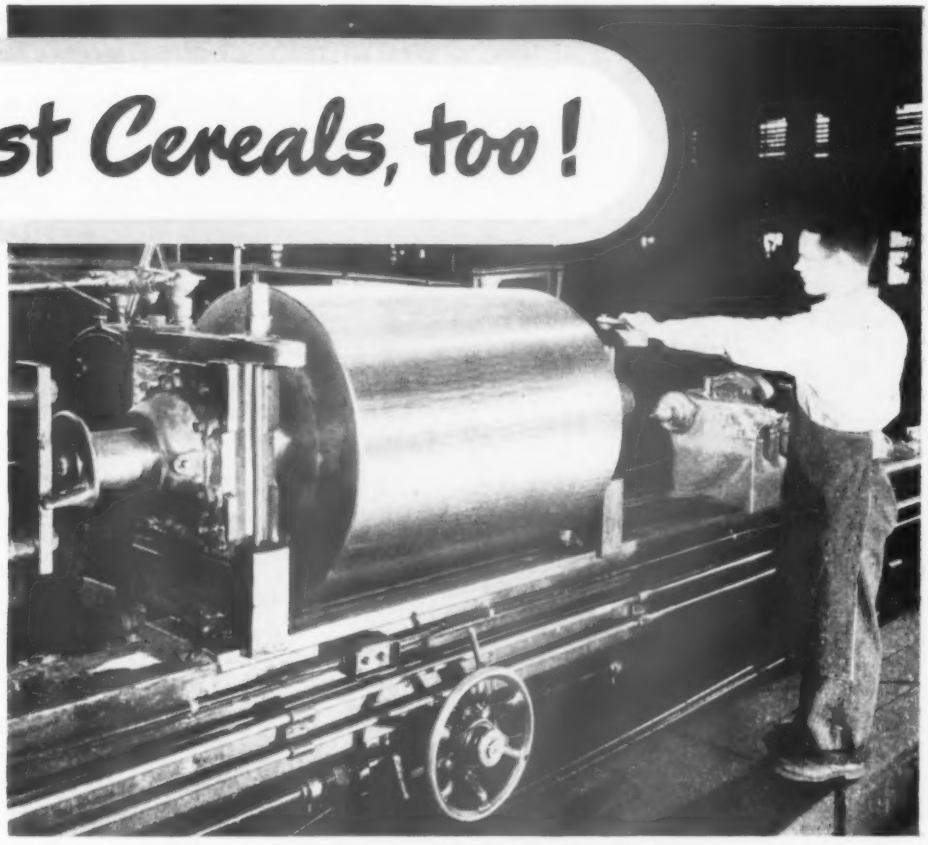
If your production requires efficient, economical preparation of sand, investigate Clearfield. You'll find the complete story in catalog No. 77. Write for it today.

CLEARFIELD MIXER

CLEARFIELD MACHINE COMPANY

CLEARFIELD PENNSYLVANIA, U. S. A.

Breakfast Cereals, too!



...NEED THE HARD, LONG-LASTING SURFACES OF

Republic CHATEAUGAY PIG IRON

Vitally important in the manufacture of modern breakfast cereals are the large "flaking" rolls which change exploded kernels of grain into crispy, appetizing cereal flakes.

Because machinability, as shown in the photo above, heat-resistance and hard, wear-resisting surfaces are "must" requirements in these rolls, many of them are made of Republic CHATEAUGAY Pig Iron.

CHATEAUGAY is Republic's low-phosphorous, copper-free pig iron which has solved countless foundry casting problems. Its advantages: *consistently uniform "physicals" held within narrow predetermined limits . . . uniformly fine grain structure . . . fast-flowing and even-cooling characteristics.* These are just a few.

Write today for the complete cost-saving story about Republic CHATEAUGAY Pig Iron.

REPUBLIC STEEL CORPORATION
GENERAL OFFICES • CLEVELAND 1, OHIO
Export Dept.: Chrysler Bldg., New York 17, N. Y.

Republic PIG IRON

"CHATEAUGAY"	"REPUBLIC"	"PIONEER"
Low-Phosphorus, Copper-Free	(Northern) Foundry, Basic and Malleable	(Southern) Foundry and Basic

REPUBLIC STEEL

ALSO TRUSCON FOUNDRY FLASKS • REPUBLIC CORE WIRE • FOUNDRY NAILS

Zirconium Base COMBUSTION TUBES FOR HIGH TEMPERATURES

Zircotubes have proved to be more satisfactory and more economical than others in the determination of carbon and sulfur by the combustion method. There are several outstanding reasons for this superior performance.

1. **Greater resistance to temperatures up to 2800° F.—tubes do not tend to crack or sag at high temperatures.**
2. **Not affected by thermal shock—a cold tube can be inserted in a hot furnace without damage.**
3. **Greater resistance to metal splatter.**
4. **Tubes remain gastight over much longer service life.**
5. **Tubes are round, straight, and have a smooth, accurate, uniform bore.**

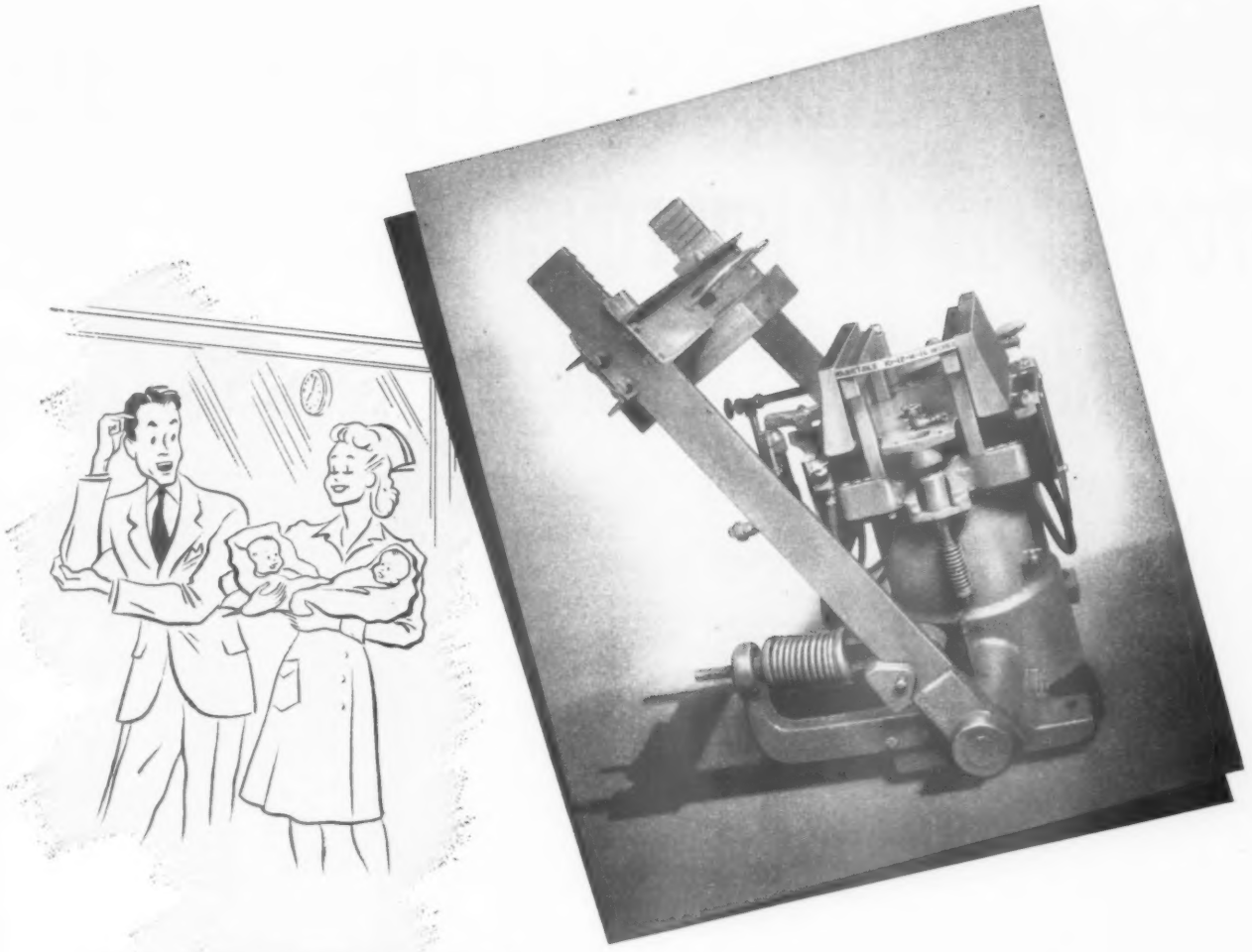
A complete range of sizes are available in stock and deliveries can be made promptly. Write for folder describing complete line of equipment for carbon and sulfur determinations.

***Write for descriptive folder to Dept.* E**

Harry W. Dietert Company

9330 ROSELAWN AVE. • DETROIT 4, MICHIGAN

DIETERT SAND MOLD CONTROL MOISTURE SULFUR CARBON EQUIPMENT



IT DELIVERS WHAT FOUNDRYMEN EXPECT

QUALITY molds and more of them—long life—low upkeep—flexibility that puts the machine "at home" in either production or jobbing shop . . . that's the story with this Tabor Yoke-type Jar-squeeze Flask-lift machine.

Design is the answer! Pattern plate supports and flask-lift sides keep a proper relation between pattern plate and flask surfaces. This means a "sand seal" when the mold is closed. Finning is eliminated . . . savings result.

Tolerances are so close that the match on the castings will depend only on the alignment of patterns.

In addition to its high-production features, this machine is flexible. Its 13"cylinder delivers a uniform squeeze—a smooth 4" draw. Adjustable open-end frame takes pattern plates 10" to 16" wide, at lengths limited only by the 260 sq. in. plate area. Also available with column- or cantilever-type head.

Write today for Bulletin #451 describing this worthy member of the Tabor family—a line of molding machines and allied foundry equipment built to *deliver* what foundrymen *expect*.

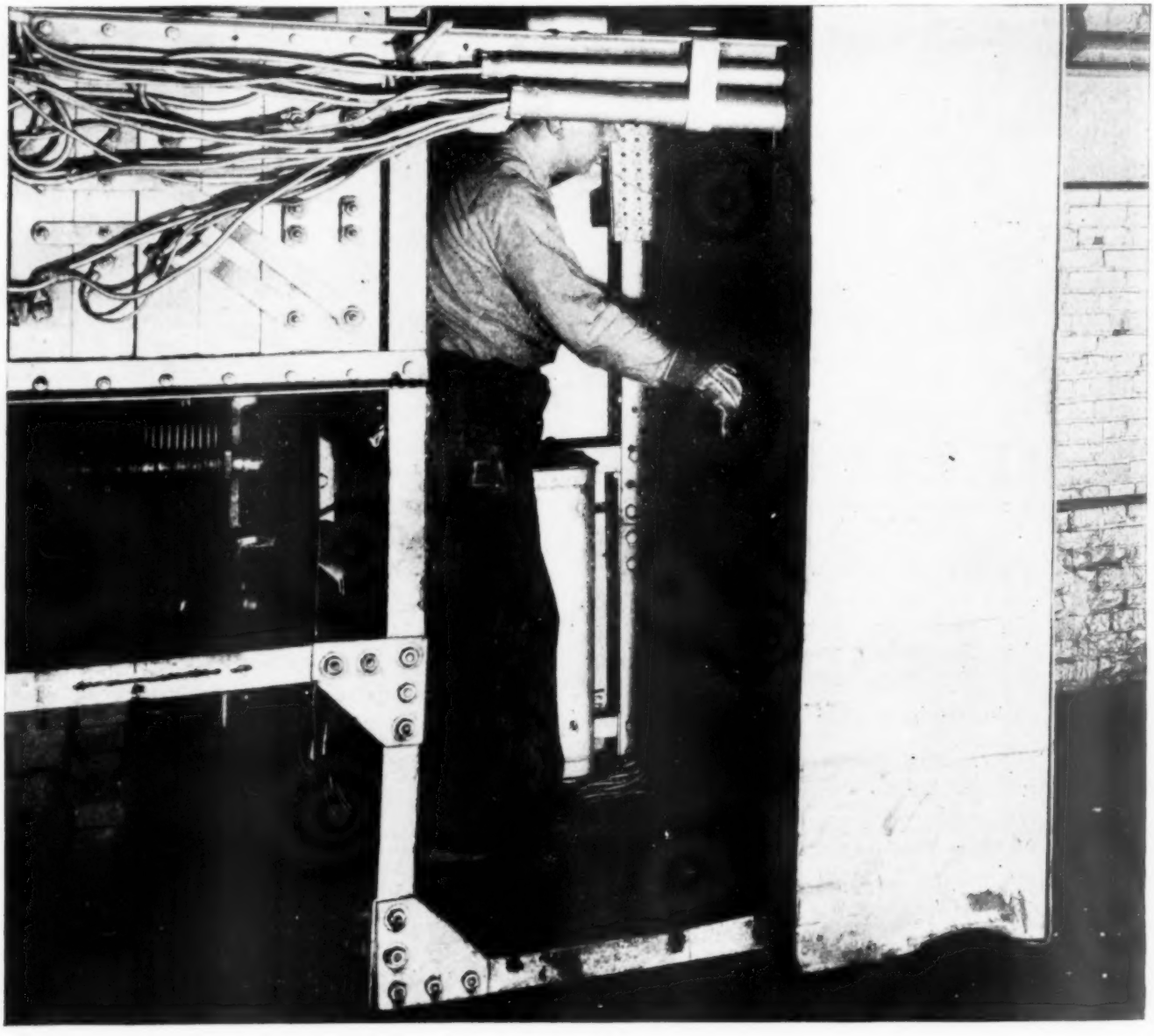
REPRESENTATIVES
Snyder Foundry Supply Company, Los Angeles, California; Gallagher Foundry Supply Company, San Francisco & Oakland, California; Carl F. Miller & Company, Seattle, Washington; M. W. Warren Coke Company, 1017 Olive St., St. Louis 1, Mo.; E. R. Frost Co., Inc., Minneapolis 14, Minn.

FOUNDRY EQUIPMENT MANUFACTURERS ASSOCIATION, INC.

The **TABOR** *Manufacturing Co.*

SINCE 1884 MANUFACTURERS OF FOUNDRY MOLDING MACHINES
6225 TACONY STREET • PHILADELPHIA 35, PENNA.

FERROCARBO Briquettes increase production of Improved Quality Malleable Castings at Less Cost



For a more complete realization of the possibilities of FERROCARBO Briquettes in your plant—we suggest a discussion with our metallurgists. Informative literature is also available for the asking.

IN CUPOLA MELTING OF MALLEABLE IRON by the duplex process—close daily checks consistently reveal sizeable reduction of scrap castings made possible through the use of FERROCARBO Briquettes. Greater production economy and improved product performance for the user are often given in expressing preference for this modern practice. Also considered of importance are several other advantages. Among these, six are briefly summarized as:

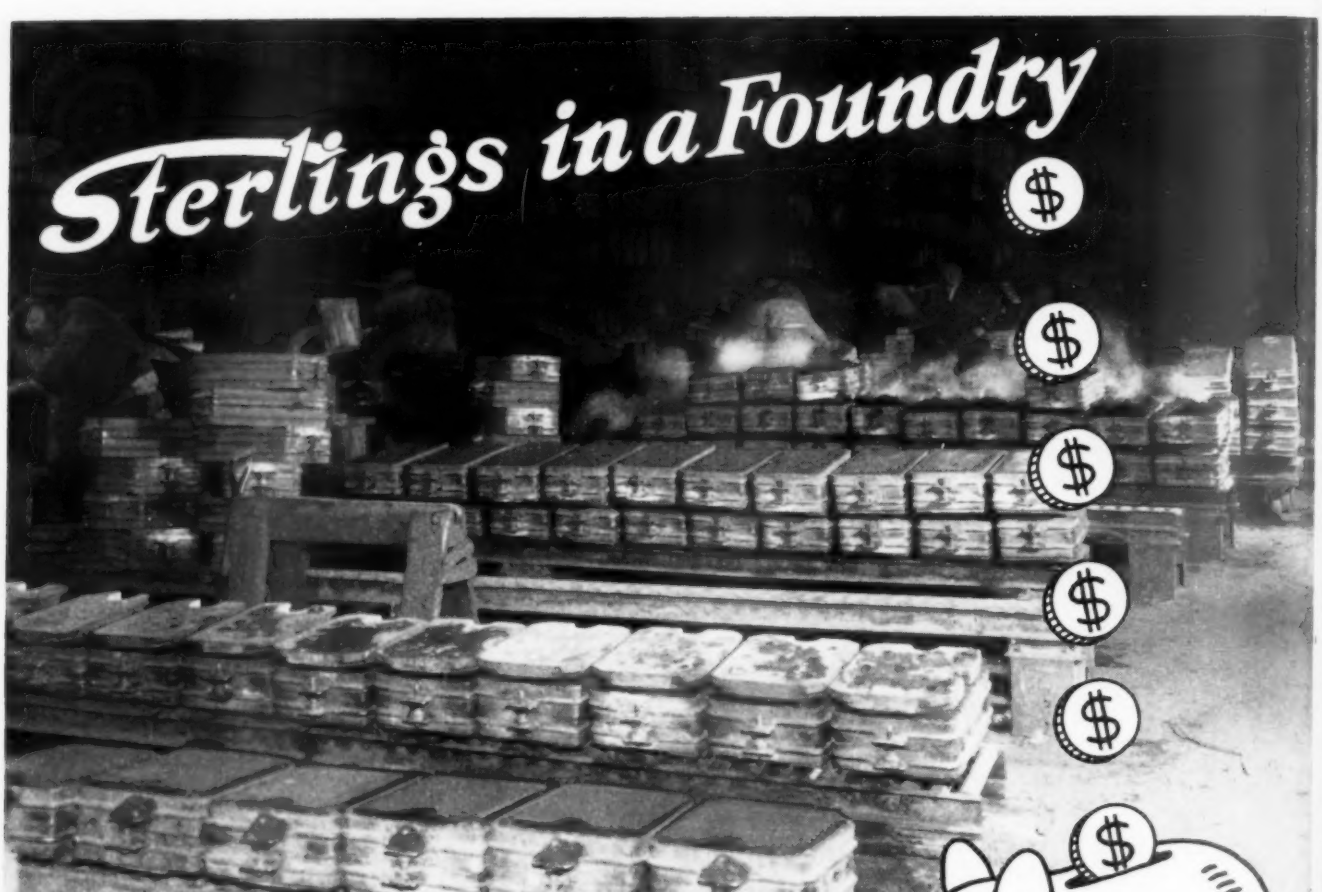
1. Thorough deoxidation.
2. Higher metal temperature at cupola spout—prolonged increase in fluidity.
3. Less tendency for internal shrinkage.
4. Elimination of shrinkage cracks and hot tears close to or at point where risers feed castings.
5. Less breakage of castings during "shake out." This results from reduction of massive primary carbides with their marked planes of weakness.
6. A finer, tougher carbide structure with evenly dispersed graphite nodules is provided in shorter time.

THE CARBORUNDUM COMPANY, Refractories Division, Dept. L-77, Perth Amboy, New Jersey

FERROCARBO Distributors: Kerchner, Marshall & Co., Pittsburgh, Cleveland and Birmingham; Miller and Company, Chicago, St. Louis and Cincinnati

"Carborundum" and "Ferrocarbo" are registered trademarks which indicate manufacture by The Carborundum Company

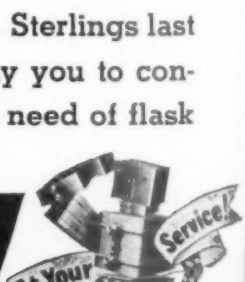
Sterlings in a Foundry



Like money in the Bank

Style "S" Sterling with cope and drag interchangeable. Note how easily molder guides cope over pins when closing.

The old adage, "A penny saved is a penny earned," is being proved by more than 4000 satisfied users of Sterling Flasks. Sterling has studied the needs of molders. That's why Sterling Flasks have these money-saving features: All-steel, welded construction . . . Solid center re-inforcing rib . . . Square flanges . . . Full-width bearing . . . Pin lugs and handles combined for easy handling. Sterlings last longer, therefore cost less. It will pay you to consult Sterling the next time you are in need of flask equipment.



Sterling FOUNDRY FLASKS

STERLING WHEELBARROW COMPANY • Milwaukee 14, Wis., U.S.A.

A 5221-1P

"SIMPSON MIXER UNIT *in our core room is highly satisfactory"*

THE MARYLAND CAR WHEEL COMPANY
BOX 1604
BALTIMORE, MD

September 6, 1946

Mr. Bruce Simpson, President
National Engineering Company
549 West Washington Boulevard
Chicago, Illinois

Dear Sir:

It is always a great satisfaction to a management when they make a capital investment to find that it works out efficiently.

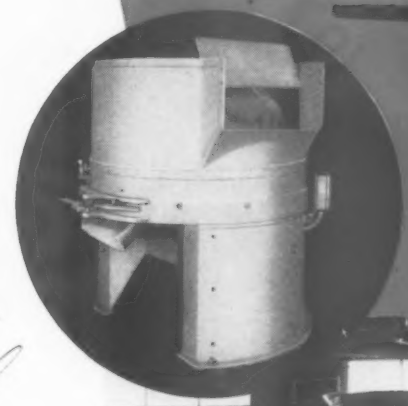
The installation of a Simpson Mixer unit, complete with loader hoist, in our new core room has been that type of installation and, since it was first started, it has been highly satisfactory in all regards.

This has been the result of the efficient engineering help that your organization gave us, when we planned the layout, and I am very glad to give your organization full credit for their share in the successful operation.

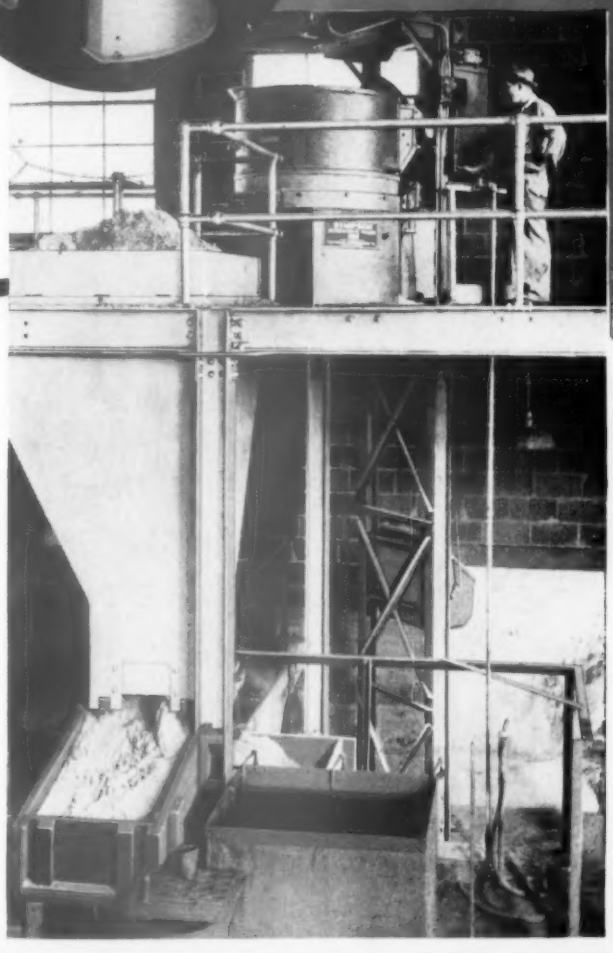
Very Sincerely,

D. H. Sherwood
President

DHS:C



Left: Close-up of the Simpson No. 1-H Mixer. Handles 4 to 5 cu. ft. of sand. Developed for better core sand preparation, and for use on molding sand in smaller foundries. Utilizes same "mulling" principle of mixing as larger Simpson Mixers.



The Maryland Car Wheel Company, like so many other foundries, has found that their Simpson No. 1-H Mixer Unit gives them consistently satisfactory service . . . and since this letter was written, this company has ordered another Simpson Mixer, loader and aerator . . . further proof of Simpson performance.

Shown at the right is the No. 1-H Simpson Mixer Unit installed in the Maryland foundry core room, complete with National Bucket Loader and control panel . . . a highly efficient unit requiring a minimum of floor space.

The "efficient engineering help" mentioned above is yours for the asking . . . to help you obtain *better* sand *faster*, at *lower cost*. *Write for details.*

MANUFACTURER'S FOUNDRY EQUIPMENT ASSOCIATION, INC.

NATIONAL ENGINEERING COMPANY

608 MACHINERY HALL BUILDING • CHICAGO 6, ILLINOIS

Manufacturers and Selling Agents for Continental European Countries—The George Fischer Steel & Iron Works, Schaffhausen, Switzerland. For the British Possessions, Excluding Canada and Australia—August's Limited, Halifax, England. For Canada—Dominion Engineering Co., Ltd., Montreal, Canada. For Australia and New Zealand—Gibson, Battle & Co., Pty., Ltd. Sydney, Australia

MAKE *Jeffrey* HEADQUARTERS FOR FOUNDRY EQUIPMENT

A Modern Mold Conveyor Installation Showing Both Molding and Pouring Stations

What Jeffrey Makes

MOLD CONVEYORS
PADDLE MIXERS
FLASK FILLERS
SCREENS
AERATORS
BIN VALVES
SANDITIONERS
CONVEYORS
BUCKET ELEVATORS

THE JEFFREY MANUFACTURING COMPANY

ESTABLISHED 1877

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Complete Line of Material Handling, Processing and Mining Equipment

Clear The Air for Production...

with KIRK & BLUM Downdraft Dust Control

● Dust-laden air in your shop not only brings protests from workers . . . dust makes itself felt continuously in your profits.

Pioneered by Kirk & Blum, *Down Draft* Dust Control Systems offer new cost reduction in castings cleaning. The dust produced in grinding, chipping and other operations is removed as soon as formed. Modern K & B Systems work so effectively that frequently cleaning operations are carried on in the same department with precision tools.

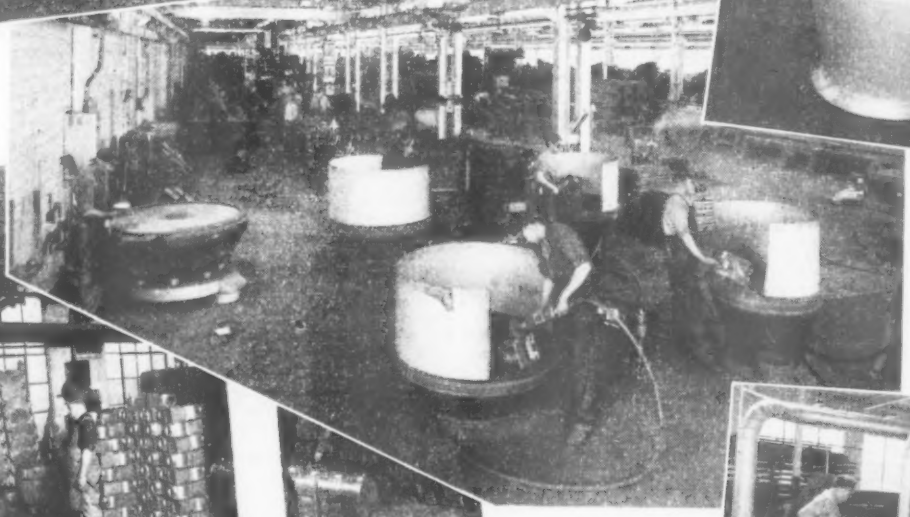
Whatever your problem in dust control, call in Kirk & Blum . . . an organization of engineers and mechanics, backed by more than 40 years of experience . . . yours for the asking. Illustrated below are a variety of Kirk & Blum *Down Draft* installations. The Kirk & Blum Mfg. Co., 2808 Spring Grove Ave., Cincinnati 25, Ohio.

KIRK and BLUM

Write for any of these catalogs:
"Dust Collecting Systems in Metal Industries"
"Blower Systems for Woodworking Plants"
"Fan Systems for Various Industries"
"Industrial Ovens"
"Data on Kirk & Blum Production Facilities"

Left: Grinding castings in the R. K. LeBlond Plant

Right: Grinding operation at Cincinnati Bickford



Below: Surface grinding at Hobart Mfg. Co.

Center: Installation at Monarch Machine Tool Co.

Right: Installation at Cincinnati Shaper Co.

When COMPARING the COSTS of DUST COLLECTORS

INCLUDE the OPERATING and MAINTENANCE EXPENSES

Look beyond the purchase price . . . important as that is . . . when you compare dust collectors. See what features are provided to insure low cost of operation and freedom from costly, troublesome, time-consuming maintenance and repairs.

On this score the Dustube makes all the difference in the world. For example: the Dustube has few moving parts; there is practically no wear on the cloth tubes because they are never under tension and there is no contact with metal that will abrade and corrode; the condition of every tube can be instantly determined without recourse to disassembly; tube replacement, though seldom required, can be made by one man without tools in just a few seconds; the resistance to air flow is much lower than in any other cloth type collector of equal capacity . . . and this means real power savings.

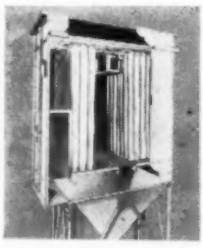
These and many other cost-saving features have put the Dustube "out front" among foundries everywhere. Write for latest literature giving complete facts upon which to base *your* decision.

SIMPLE

It is a simple matter to install a Dustube filter bag. Just hang it on a hook attached to the shaker channel overhead and insert the spring-band at the opposite end in the cell plate above the dust hopper. One man can do this in a few seconds without tools.

ECONOMICAL

Lower maintenance costs because of simplified design. There are few moving parts to wear. Shaking periods are shorter and less frequent. Tubes are inexpensive to buy, economical to ship and store. Lower resistance to air flow saves costly power.



EFFICIENT

Results of performance prove that Dustubes meet the most exacting requirements. Efficiency by weight: 98% and more; by dust count: discharged air shows less than 10 million particles per cubic foot from 2 to 10 microns in size (as determined by the impinger method).

THOROUGH

Accumulated dust is completely removed from the tubes by the whipping motion imparted by the shaker while the tubes are limp, loose, and deflated . . . This results in lower operating resistance, longer cloth-life, and direct savings in horsepower.

Write today for more complete information about the many advantages of DUSTUBE dust collectors. Ask for Catalog 72.

American
WHEELABRATOR & EQUIPMENT CORP.
(FORMERLY AMERICAN FOUNDRY EQUIPMENT CO.)
505 S. Byrkit St. Mishawaka, Indiana

dustube
DUST COLLECTORS

Benefits Result from Mechanization Trend

AS A direct result of the manpower difficulties developed during the war and continuing throughout the reconversion period, casting operations are being mechanized to a greater extent than ever before. This is not just a blind stab at a pressing problem, but rather is a studied effort to meet the requirements of particular foundry practices on the part of hundreds of individual companies. The work which has been under way for the past two years and is continuing at an undiminished pace, varies in degree from the application of machines to a few operations, to the almost complete mechanization of all factors in the production cycle, from unloading raw materials in the yard to loading castings on the foundry shipping platform.

As might be expected, a large percentage of present equipment installations has to do with handling materials. In foundries, where probably in excess of a hundred tons of materials, including metal, sand, flasks, molds, etc., are moved in the production of one ton of castings, the field of mechanical handling offers an almost unlimited opportunity for the reduction of costs and the elimination of a difficult labor problem. Over a period of years many developments in the field of materials handling equipment have been adapted to the particular problems encountered in the production of castings, so that usually any foundry handling problem may be approached from the standpoint of several types of mechanical equipment, and selection may be made on the basis of the peculiar conditions of the individual shop.

But the movement toward foundry mechanization goes far beyond the matter of materials handling. Every operation is being given careful attention. For example, greater knowledge of the properties and behavior of molding and core sands has proven the need for complete sand control. This has resulted in the more widespread use of mechanical sand preparation equipment. Molding machines have been improved and new types have been introduced to speed production, especially in connection with conveyor lines and production molding units. One of the latest developments in the molding field is an electrically controlled, hydraulically operated machine designed for high speed production. Flasks are placed on the pattern plate by hand and from that point all operations are automatic, including the stacking of the mold and the pushing of the stack from the machine onto the mold conveyor for transfer to the pouring station. Core blowing has made tremendous strides, core and mold ovens depend to a greater extent on mechanical handling and control, heat treatment is becoming a continuous operation, and new machines plus rearrangement of equipment have streamlined cleaning departments. Many other interesting examples can be cited.

Mechanization is not a cure for all foundry production problems. But the pronounced trend in many foundries toward an increased use of specialized equipment in the production of castings is providing better places in which to work, is eliminating the need for so-called "common labor" in foundries, and should result in lower production costs.

Frank G. Steinebach
Editor

ELECTRONIC Core Baking

By R. W. CRANNELL
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IN April, 1946, foundrymen attending the AFA Foundry Show in Cleveland were shown a new principle in core baking, based on dielectric heating. The questions which foundrymen asked after seeing the possibilities of the mechanized and speedy process, required much additional investigation to see how this idea could be fitted into actual foundry practice. For the past year that development work has been carried on, and how it has progressed—as pertaining to investigations at Lehigh Foundries Inc.—will be of interest to others in the industry who have been awaiting further news of the process.

To review for a moment, dielectric baking results from the heat resistance of poor thermal conductors. The materials which make up a dry sand core—sand and binder—are polymerized as a result of rapidly reversing current—20 megacycles—which sets up a heat condition within the core. Instead of creating a high temperature only on the core surface, as in the case of ordinary oven baking where heat travels from surface to center, dielectric heating distributes heat uniformly throughout the mass of the core placed in its high-frequency field. The core thus bakes evenly and speedily all the way through.

That is the theory in brief. In practice it has been found that this equipment, in its present state of development, cannot be expected to displace the conventional type of core ovens. It rather is considered as supplementary equipment, to be especially designed for each individual foundry which has a need for mass production cores of similar size and shape.

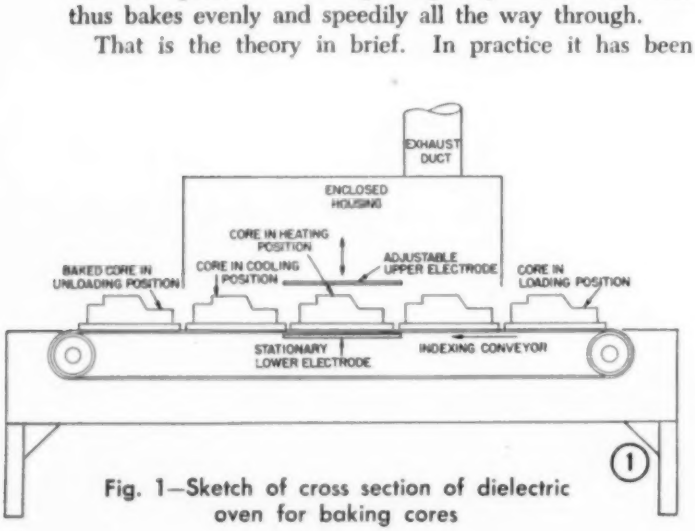


Fig. 1—Sketch of cross section of dielectric oven for baking cores

Every ferrous foundry has been plagued with the necessity of making dry sand cores which would have certain unusual characteristics. These are what we call the "tough core jobs," and include cores which must have the following characteristics:

1. Good green strength, so that the core can be handled easily in its green state.
2. Provide clean smooth casting finish.
3. The core must generate a minimum amount of gas and be capable of carrying out through core openings any gas which is generated.
4. Resistance to cutting or veining, so that the cored cavity will be free from fins.
5. Good collapsibility, so that as soon as the metal skin is formed and starts to cool and consequently shrink, the core will not retard the metal from following its natural tendencies.
6. Good shakeout properties.

It was found that the dielectric oven, when teamed with synthetic resin dry binder, did an excellent job of making cores to meet these specifications.

Before this core mix and the method and cycle used for baking these cores are described, it is desirable to give a brief explanation of the dielectric heating process. The dielectric oven in use is shown in Fig. 2.

Dielectric heating of a material consists of placing it between parallel plates or conductors. The material to be heated becomes the dielectric or insulating medium of a condenser. The plates of the condensers are connected to a source of rapidly varying voltage. Under the stress of this voltage, the molecules of the material tend to deform. The resistance of the molecules to this deforma-

Fig. 2—Dielectric oven with plate of cores being placed on input end of conveyor

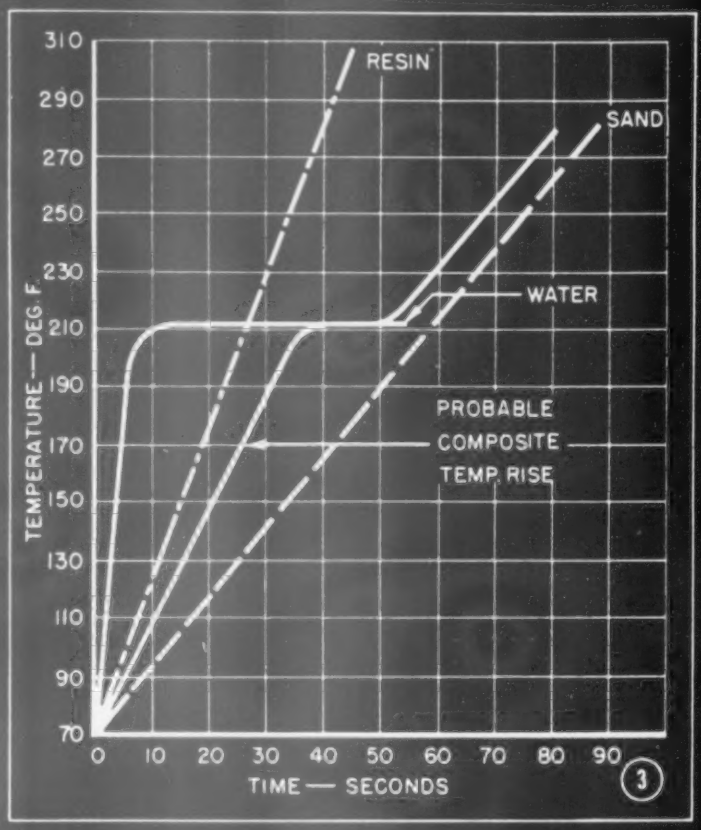


Fig. 3—Representative temperature rise curves for sand, resin, water mixtures

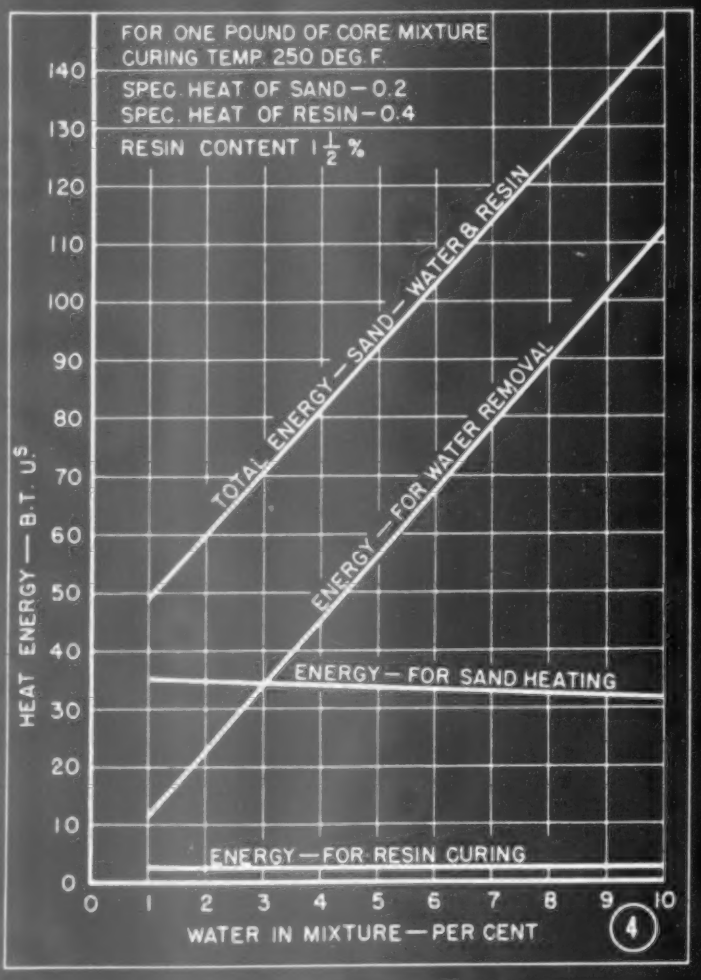


Fig. 4—Curves showing variation in heat requirements with varying water content in core sand

tion consumes energy, which appears as heat in the material. The process of dielectric core baking is similar to diathermy as used and discussed medically.

After considerable experimentation with various types of resins, it was found that urea formaldehyde binder proved the most satisfactory. This binder is thermosetting. In other words, it requires heat to polymerize, but after polymerization any subsequent exposure to temperature of the magnitude used will not materially affect the strength. This is one of the facts which makes the use of dielectric heating advantageous in baking a core. The curing of cores made with synthetic resin-type binders is a function of time and temperature.

These binders differ very appreciably from core oils with which all foundrymen are familiar. For example, urea formaldehyde binder will be cured at a temperature between 200 F and 300 F in a matter of minutes with dielectric heating. Since the heat is generated from within the material itself, there is no requirement to hold this temperature for a long period of time. This binder breaks down at 350 F, which means that considerable care would be required to handle it in a conventional core oven. With the dielectric oven, about half of the heat required is for the purpose of effecting the removal of the water present in the core mix; therefore, when this water or moisture has been removed, the heating of the core rapidly decreases and there is no chance of overbaking.

Considering the three main constituents of any core mix to the dry sand, water, and urea formaldehyde resin, if these constituents were heated separately, they would un-

dergo various temperature rises when exposed to dielectric heating. These rates would be nearly proportional to the dielectric constants of the materials. Water, with a dielectric constant of 80, would show the fastest heating. The resin, with a constant of from 4 to 6, would be next. Sand with a constant of 2 to 3, would heat the slowest. Typical curves showing this relation are illustrated in Fig. 3.

The temperature of the water, of course, cannot exceed 212 F, and will remain at that temperature until it is evaporated.

Superimposed on these three curves is an estimated curve showing the expected temperature rise of the composite mass. From this, it will be seen that the curing temperature of the resin should be as close as possible to 212 F in order to effect curing as quickly as possible.

Heating energy requirements can be demonstrated by the following example. Assume a core sand mix made up of: 95.5 per cent dry silica sand, 3.0 per cent water, 1.5 per cent urea formaldehyde resin. In order to raise the temperature of this material from room temperature of 70 F to 250 F would require the following amounts of energy, assuming 0.4 and 0.2 as the specific heats of resin and sand respectively.

To raise the water from room temperature of 70 F to 212 F: $0.03 \times 142 \times 1 = 4.26$ Btu.

To evaporate the water using 980 Btu/lb latent heat of evaportion: $0.03 \times 980 = 29.40$ Btu.

To raise the resin to curing temperature: $0.015 \times 180 \times 0.4 = 2.7$ Btu.

To raise the sand to resin curing $0.955 \times 180 \times 0.2 = 34.38$ Btu.

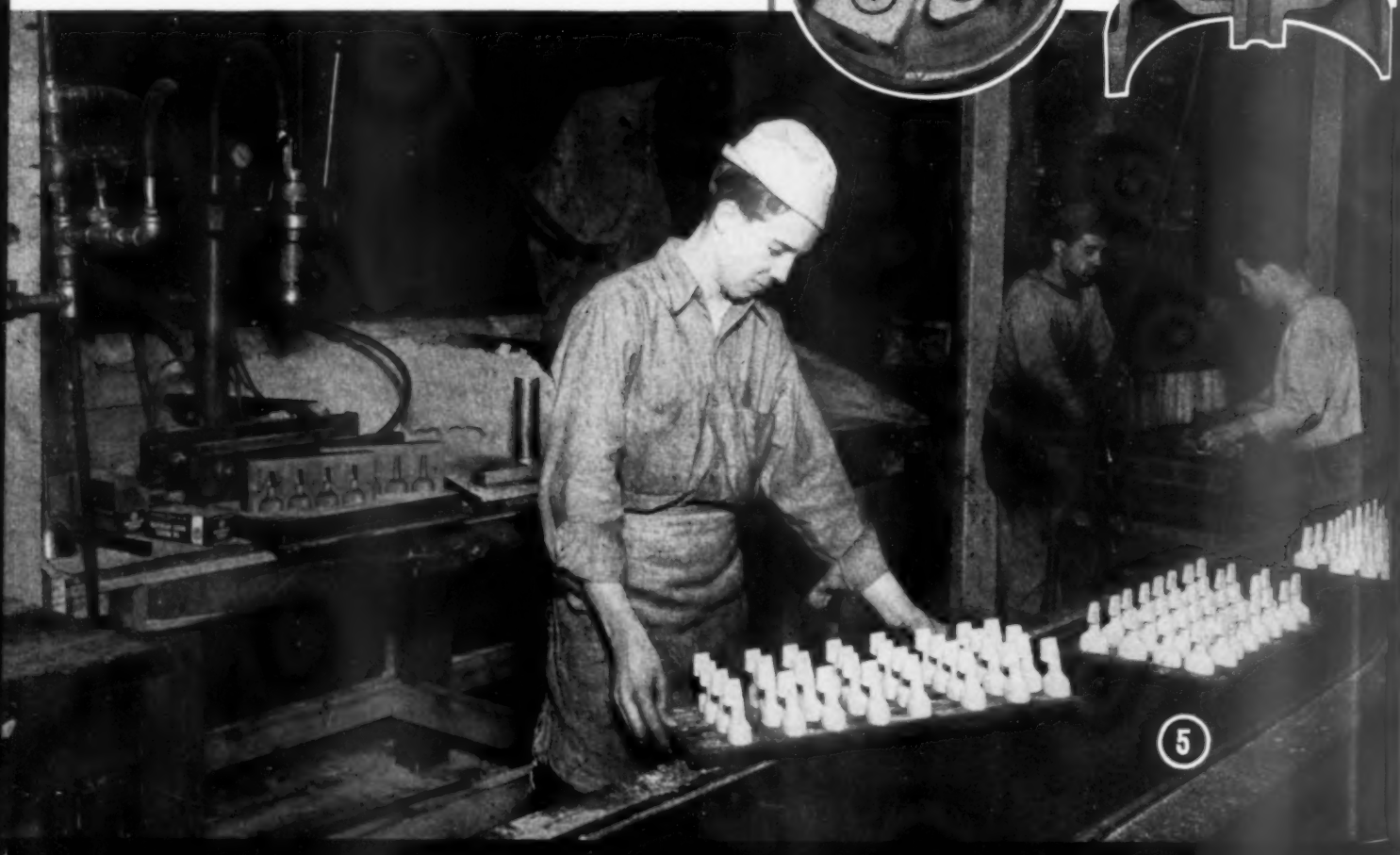
Total of the foregoing is 70.74 Btu. It can be seen from this that almost half of the heat required is to effect the removal of the water. This also illustrates the importance of keeping the water content as low as possible. This is further illustrated by Fig. 4. It must be remembered that these figures are hypothetical; however, actual test figures, in which kilowatt consumption was measured indicated an efficiency at the electrodes of approximately 62½ per cent.

The equipment used, as shown in Figs. 1 and 2, consists of a completely enclosed conveyor tunnel having the bottom horizontal electrode plate fastened rigidly and having the top electrode plate adjustable vertically. These electrodes are placed lengthwise in the center of the tunnel. A conveyor of the indexing type is arranged so that a plate of cores when set on a flat conveyor belt will be indexed by the time-setting of the equipment so as to advance into a position between the electrodes where the plate of cores pauses long enough to be baked. The conveyor is activated by an air cylinder.

The cores shown in Fig. 8 were permitted to stay in this curing or baking zone for 2½ minutes. Standard transite core plates 12 x 24 x ½ in. thick were used. Actually,

Fig. 5—Plates of cores as blown and set on conveyor belt

Fig. 6—Typical refrigeration casting. Right-hand view shows a section through the cored muffler cavity



these cores could be handled after coming out of the baking zone; however, experience proved that the core plate was too hot at this point; therefore, the equipment was arranged so that each plate of cores would index forward one station, which would give the core plate 2½ minutes to cool while another plate of cores was being baked. This added time permitted the core plates to be handled readily. When the conveyor has completed its indexing stroke so that cores are in the baking zone, power is automatically applied, and the baking starts. In about 20 seconds, evaporation of the water begins. This can be noticed as a slight cloud leaving the cores. The rate of evaporation increases quite rapidly, so that at the end of one minute steam is escaping freely from the cores and recondensation of any of the moisture is prevented.

After all water has been removed, baking is continued for another minute to assure complete curing of the resin. The power then turns off automatically, the conveyor indexes the next plate of cores into position and the process

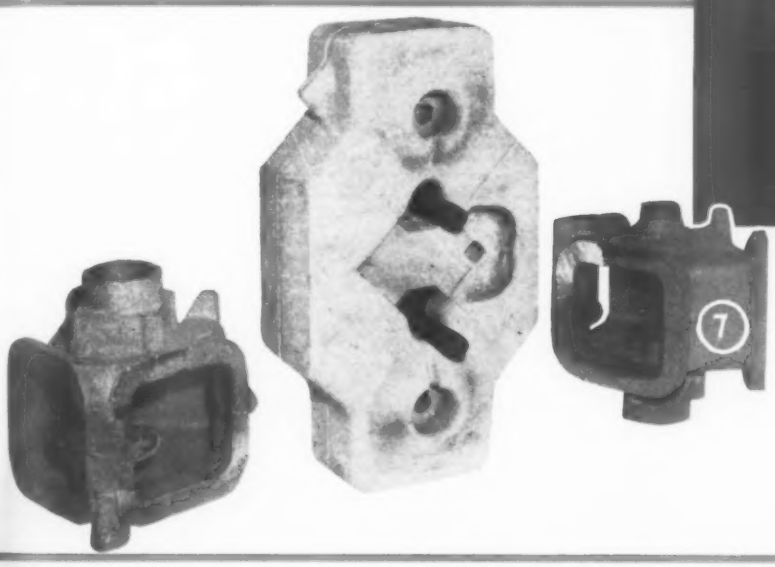


Fig. 7—Another type of refrigerator casting showing a much larger core that was made in the dielectric oven and the type of castings produced from it

Fig. 8—Cores being baked in dielectric oven. Slight cloud of vapor at left of cores is moisture being dissipated

is repeated. The core oven has a capacity of putting 800 Btu per minute into the work. This has an input rating of 28½ kva at 90 power factor. This oven, as used, handles 12 in. x 24 in. core plates but will accept a core having a length of 24 in., a width of 16 in., and a height of 6 in.

Fig. 6 shows two views of a refrigeration casting. The left-hand view is the entire casting; the right-hand view is a section through the receiver, or muffler, cavity of this casting. It was the production of the core to make this cavity on which this oven and dry binder did an outstanding job. The cavity must be free from fins. There can be no veining of the metal in this cored pocket. Gas generation must be kept to a minimum, since all gas must be exhausted through the small neck of the core. The cored surface must be smooth and free from surface sand or dirt because of the difficulty of cleaning this pocket and because any dirt left on the surface might be picked up by the refrigerant and carried through the system, thus doing harm. The core must give good shakeout characteristics. It must have sufficient green strength to be stood up on plates as shown on Fig. 5. All cores were blown on a regular type core blowing machine.

The core mix used for production cores is shown below. The present cost of the materials used is given to enable comparisons to be made between the cost of this mix and that of a standard mix.

250 lb dry sand (.22c per lb)	$ .55
5½ lb dry binder (21.5c per lb)	1.18
2¼ lb corn flour (6.3c per lb)	.14
10 oz powdered boric acid (5.5c per oz)	.03
1¼ qt kerosene (10.8c per gal)	.03
4 qt water	
Total cost	$1.93

The sand, binder, corn flour, and boric acid powder are mulled together for 2 minutes. Water is added and mulled for 1 minute. Kerosene is added and mulled for 40 seconds. This method of mixing must be carefully followed for good results. The sand used is a dry New Jersey silica sand, screening as follows:

Sieve size 40, approximately 1 per cent retained; sieve 50, 2 per cent; sieve 70, 23 per cent; sieve 100, 41 per cent; sieve 140, 23 per cent; sieve 200, 6 per cent; sieve 270, 3 per cent, and pan, 1 per cent.

The dry binder finally adopted is a urea formaldehyde binder. It proved considerably better for these cores than several phenol formaldehyde binders which had been tried. It has remarkable (*Please turn to page* 240)

GASES CAUSING UNSOUNDNESS IN Copper-Base

Information on the relative importance of various types of gas-metal reactions in copper-base alloys is summarized in this third of a series of articles based on investigations sponsored by the Non-Ferrous Ingot Metal Institute

THE first paper of this series described the types of unsoundness in 85-5-5-5 alloy caused by gas evolution. The second dealt with the theory of gas-metal reactions in copper-base alloys. On the other hand, this paper summarizes the information on the relative importance of the various types of gas-metal reactions in copper-base alloys.

As indicated in the first of this series of papers, the problem of gases in copper-base alloys is important, because it is one of the main factors which determine the soundness and properties of copper-base alloy castings. Consequently, a great deal of work has been done on the causes and control of the unsoundness resulting from the evolution of gas during the solidification of the casting.

Hydrogen as a Cause of Unsoundness—As indicated in the first paper (THE FOUNDRY, May, 1947), hydrogen can be a source of unsoundness by either Type 1 gas evolution or Type 2 gas evolution. According to Beaver and Floe,[8] the solubility of hydrogen in copper and copper-tin alloys is as follows:

TABLE II—SOLUBILITY OF HYDROGEN IN COPPER AND COPPER-TIN ALLOYS

Composition	Solubility in cc of H_2 per 100 Grams of Metals: at 2012 F	at 2192 F	at 2372 F
Pure copper	5.9	7.4	9.4
90% copper, 10% tin	4.4	5.5	7.0
80% copper, 20% tin	3.0	4.0	5.2

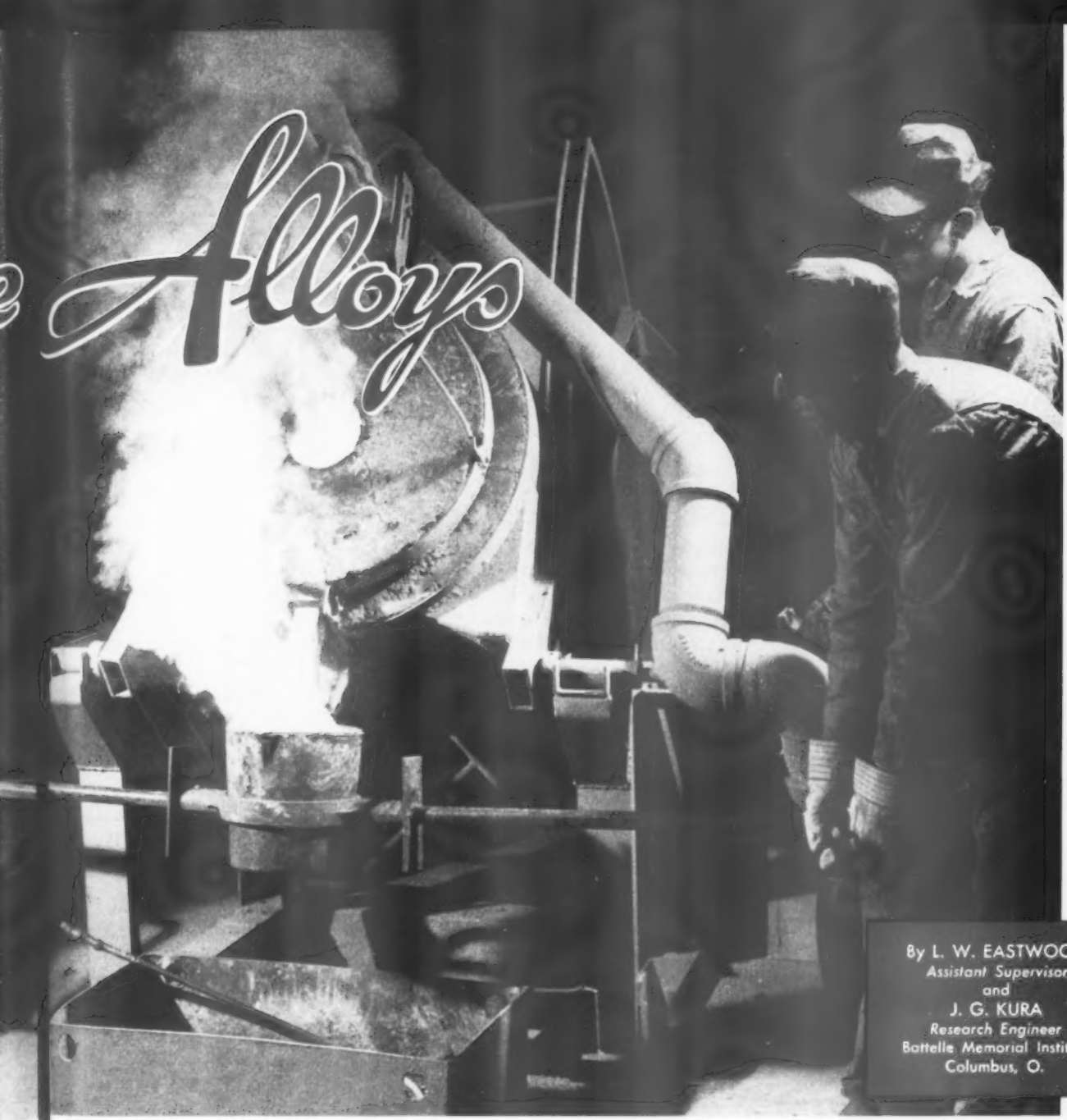
Examination of these data show that the solubilities of hydrogen in copper-tin alloys are very considerable. Thus, if 3 cc of hydrogen per 100 grams of metal were in solution, and all of this were evolved at the time the melt solidified, the volume of gas at the solidification temperature would be approximately equivalent to the volume of the metal. Thus, tin decreases the solubility of hydrogen, but this information is actually of academic importance, since the hydrogen solubility in high-tin alloys is several score times the amount required to produce a substantial amount of unsoundness when the casting solidifies. The solubility increases with the square root of the partial pressure of the hydrogen surrounding the metal, and as the data indicate, the solubility increases substantially with increasing temperature of the molten metal bath.

When melting brass and bronze, a slightly oxidizing atmosphere produces the best results

Practically all investigators[12, 17, 23, 24, 25, 26] of the problem of gas and unsoundness in copper-base alloys agree that hydrogen is the principal source of trouble. Certainly all agree that hydrogen can be precipitated, causing Type 1 gas evolution and unsoundness in the casting. Many [9, 11, 12, 13, 26] are also agreed that the hydrogen may be oxidized to form steam in accordance with the mechanism described in the first article. As the data in Table I of that article indicate, only 0.072 cc of hydrogen per 100 grams, or 0.0000066 per cent by weight, and 0.036 cc of oxygen 100 grams, or 0.000052 per cent by weight, need combine to form steam to produce 3 per cent of voids in the solidifying casting.

Thus, it is apparent that hydrogen probably can produce unsoundness as a result of either Type 1 or Type 2 gas evolution. There is some indication that the Type 1 gas evolution produces the rather large rounded macroscopic cavities.[12] If so, this gas evolution occurs fairly early in the process of solidification. There is some evi-

e Alloys



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dence that Type 1 gas evolution of hydrogen is not harmful, since. in the absence of oxygen, hydrogen atmospheres are said to be harmless,[27] or that they cause unsoundness only when the melt solidifies rapidly, thus trapping the evolved hydrogen in the form of the large rounded cavities.[12] However, these cavities are not ordinarily encountered in foundry work. The Type 2 gas evolution, involving the formation of steam by the reaction of the residual hydrogen with oxygen, would occur late in the process of solidification and could readily account for the finer porosity described in the first article as microporosity. Certainly the Type 2 gas evolution requires very much smaller quantities of hydrogen actually in the melt than Type 1 gas evolution, but as indicated by the data, the same amount actually participates by either type of gas evolution in the production of 1 per cent voids. It must be concluded that there is a very good possibility that hydrogen produces unsoundness by both types of gas evolution, and that Type 2 is probably by far the greater source of unsoundness.

Mechanism of Hydrogen Absorption—It has already been noted that the quantity of hydrogen dissolved in copper-base alloys increases with the square root of the partial pressure of the hydrogen. This indicates that the hydrogen is present in the metal in the atomic form, either as individual atoms of hydrogen, or as a hydride containing one atom of hydrogen. This hydride could be completely undissociated, partially dissociated, or completely dissociated. In the latter instance, the hydrogen would be present as individual atoms. It is necessary, therefore, that the molecular hydrogen dissociate, or at least the immediate source of the hydrogen must be in the atomic form.

Molecular hydrogen dissociates very slightly and then only at very high temperatures. At room temperature, the proportion of atomic hydrogen as dissociated, molecular hydrogen is only 2.5×10^{-32} per cent. This degree of dissociation increases with (*Please turn to page* 200)

A Study of the Behavior of Molding

When in Contact With

SCABS, buckles or just plain loose sand lodged in the cope of the mold have been one of the most vexatious problems of the foundry industry since its inception. These defects must occur while the metal in the mold is still liquid and probably occur while the mold is being filled. Every foundry has experienced these defects, many times in sort of epidemics. Their frequency rises and falls in mysterious cycles. Suddenly the cleaning room is full of them, and just as suddenly these defects diminish leaving the foundryman mentally as well as physically exhausted, and wondering which of a dozen panaceas he tried did the trick.

It is, therefore, quite surprising that no mention has been made in the voluminous literature on sand testing as to the behavior of sand during that important period when it forms the casting; when it is in contact with liquid metal. References too numerous to mention have been made as to the correlation between room or high temperature properties of molding sand and its behavior in the mold when the mold is poured.

All such correlations are open to criticism, for there is no reason to believe that room temperature properties, green strength for example, have any bearing on the behavior of a sand at a temperature exceeding say, 2000 F. True, there may be a correlation for a particular sand, in a particular foundry, but even in this case, a room temperature property such as green strength can only be used in a correlation when it varies in some unknown degree with some other property operative at the temperature of the mold surface in contact with the metal.

Such a correlation between properties at widely different temperatures is useful if used intelligently, but can be actually dangerous if any extrapolation is made to another sand or another practice. Such extrapolations are the reason for any number of mysterious behaviors of sand that have plagued the foundry industry.

A step forward from room temperature properties in evaluating the behavior of the sand at the mold surface in contact with metal is testing the sand in a gaseous atmosphere at an elevated temperature. However, extrapolation must again be used in correlating the results of such tests to behavior in the mold itself, for conditions are different when the sand is in contact with a gas than when it is in contact with metal, even though the measured temperature is the same.

One important difference is that of change in the chemical composition of the sand in contact with the metal. Sand in contact with steel, for example, is known to pick up iron oxide in varying amounts to varying depths from the metal in contact with it. Nothing quantitative is known as to how much is picked up or, what is equally important, when this chemical change occurs. There is but brief reference in the literature to the change in the chemical composition of molding sand when in contact with other metals.

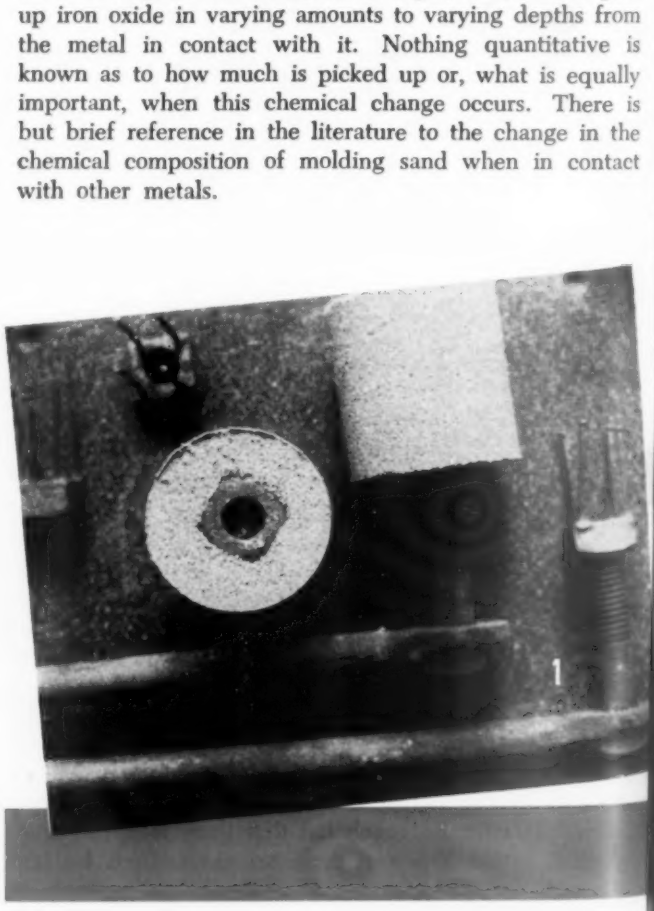

Fig. 1—Apparatus used to hold specimens on rods

Fig. 2—Effect of radiant heat. No defects. Exposure: Upper row, 60-40-20 seconds; lower row, 5-10 seconds

Fig. 3—Sand showing cracking and shelling when exposed to radiant heat. Specimens exposed 5-10-20-40 seconds

Fig. 4—Glaze formation on continuous immersion. No defects. Specimens immersed 1-5-10 seconds

Fig. 5—Buckling occurring on continuous immersion. Specimens immersed 1-2-5 seconds

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This paper was presented by the author before the annual Technical and Operating Conference of the Steel Founders' Society of America at Cleveland, June 5

Sand

LIQUID STEEL

This point is fundamental. If the chemistry of the sand does change when in contact with metal, this change must be taken into consideration in any high temperature testing when the sand is surrounded by a gas. Conversely, any reaction between the sand and the gas surrounding it will vitiate the results of such high temperature testing, and at least confuse the correlation if not make it valueless. Of course, if the sand is tested in actual contact with metal, any change in chemistry is automatically taken into consideration.

Another fundamental that must be taken into consideration when testing in a gaseous atmosphere is the rate of heat input into the sand. In a high temperature furnace the sand specimen is being heated mostly by radiation, and the rate of heat input is many times less than when molten metal is in contact with a similar specimen.

Sand and all high silica silicates are unlike metals in that, for all practical purposes, they have no definite melting points; the fusion temperature depends on a number of variables such as particle size and rate of heating. Variations in the rate of heating such as encountered when heating by radiation in a gaseous atmosphere and direct contact with a liquid can mean a difference of several hundred degrees in the glazing, sintering and fusion of the sand.

In addition, molding sand is a relatively poor conductor of heat, the rate of heat transfer, either by radiation or conduction, through the sand being many times less than the rate of heat transfer to the mold cavity surface. Therefore, the higher rate of heat transfer to the mold cavity surface when in contact with molten metal must result in an appreciably higher temperature at the mold cavity surface. Temperatures at the mold-metal interface to say 1/16-in. back from this face will approach that of the metal and be much higher during the first seconds or minutes of heat application than when the sand is heated by radiation in a gaseous atmosphere.

In other words, time is all important when dealing with silica (quartz grains)—time measured in seconds and minutes, not minutes and hours. Disequilibrium rather than simple equilibrium is the rule in these relationships. The importance of the time factor must be greater if it is desired to study those characteristics of sand that are important while the sand is in contact with molten metal. Time becomes less important if mold characteristics are to be studied after the metal has solidified as equilibrium conditions are now being approached.

It would seem that the problem divides itself nicely into two separate phases, each phase capable of being studied more efficiently and exactly using different tech-

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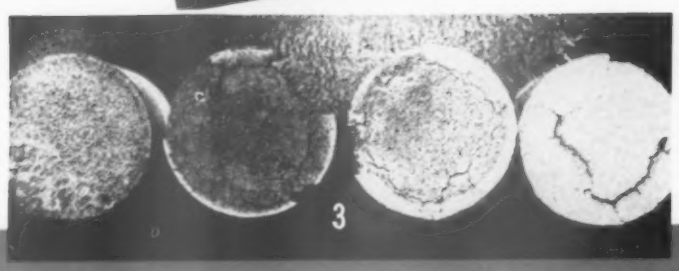
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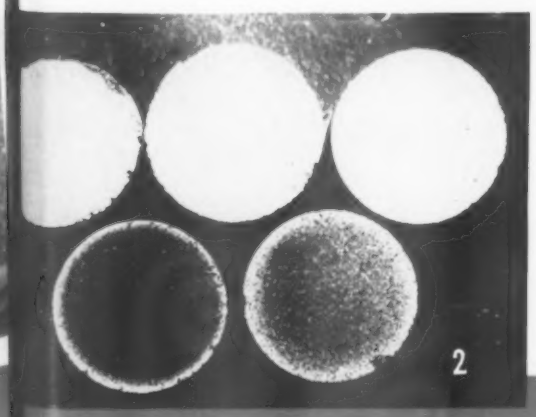
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TABLE I

Type of Sand	AFA Fineness No.	Additions	% Water	No. of Rams	No. of Grams =2"	Green Permeability	Green Strength Psi	Green Hardness	Deformation in./2"	Air Dried Strength Psi	Air Dried Hardness
Washed	65	6.0% Bentonite	3.0	½	143	250	3.8	60	.022	30	0
Washed	65	6.0% Bentonite	3.0	3	157	120	7.6	79	.023	60	5
Washed	65	6.0% Bentonite	3.0	20	170	55	16.0	92	.023	102	33
Crude	62	3.0% Bent. 0.75% Lignin 0.75% Corn Flour	3.2	½	137	430	3.4	58	.040	27	0
Crude	62	3.0% Bent. 0.75% Lignin 0.75% Corn Flour	3.2	3	155	180	7.8	81	.035	63	20
Crude	62	3.0% Bent. 0.75% Lignin 0.75% Corn Flour	3.2	20	170	65	18.1	93	...	190	63
Reclaimed	58	2.5% Bent. 1.0% Corn Flour	3.7	½	140	385	3.2	53	.031	22	0
Reclaimed	58	2.5% Bent. 1.0% Corn Flour	3.7	3	155	170	7.8	80	.030	69	10
Reclaimed	58	2.5% Bent. 1.0% Corn Flour	3.7	20	175	65	19.0	93	...	145	55

TABLE II

Crude	58	2.5% Bentonite 1.5% Dextrin	3.4	3	160	140	4.8	72	...	180	50
Crude	58	2.5% Bentonite 1.5% Dextrin	3.4	20	177	70	11.0	90	...	..	85
Crude	58	2.5% Bentonite 1.5% Dextrin	4.0	3	160	130	4.9	75	...	195	60
Crude	58	2.5% Bentonite 1.5% Dextrin	4.0	20	180	70	12.3	91	...	..	87
Crude	58	2.5% Bentonite 1.5% Dextrin	6.0	3	170	95	4.7	70	...	..	80
Crude	58	2.5% Bentonite 1.5% Dextrin	6.0	20	192	45	...	88	...	..	98

niques in handling various features of the problem.

Tests as to the behavior of sand in contact with molten metal should then be carried out in actual contact with molten metal. Defects such as scabs, buckles, erosion, penetration and veining which must occur while the metal is still molten can be detected and measured visually and need no apparatus for their detection other than a pair of eyes. This is fortunate as any apparatus that would perform in the presence of molten metal, especially those with higher melting points, would be difficult if not impossible to construct.

Defects involving strength, such as hot tearing do require some type of apparatus to measure strength and collapsibility of the sand. Fortunately these defects occur after the metal has solidified and after an appreciable time interval. Equilibrium conditions are more closely approached and the time variable is not as important as with those defects occurring while the metal is molten. The objections raised in the preceding part of this paper to heating a specimen in a gaseous atmosphere are therefore less important and the results obtained by such a test more closely approach the conditions actually present in the mold.

Danger of error due to change in chemistry of the sand is also minimized, for this change is greater just at the mold cavity surface and resistance to contraction is offered not only by the sand in contact with the metal, but also by that sand some distance back from the mold-metal interface, whose chemistry is not changed appreciably.

The tests described in this paper are then presented as a supplement to the older tests made by heating in a gaseous atmosphere and do not supersede them. These

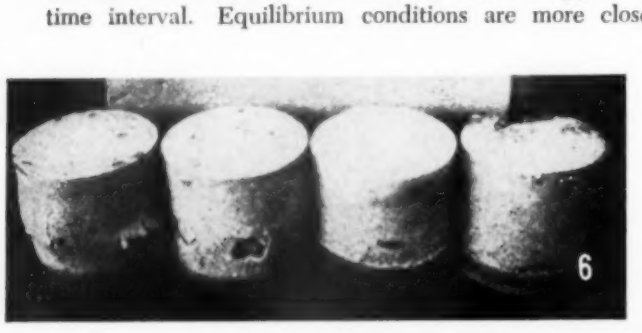


Fig. 6—Buckling and spalling on continuous immersion. Specimens immersed 2-5-10-20 seconds
Fig. 7—Extreme spalling on continuous immersion. Specimens immersed 1-5-10 seconds
Fig. 8—Another example of extreme spalling on continuous immersion of 20 and 40 seconds
Fig. 9—Spalling occurring on alternate immersion

Behavior of Molding Sand

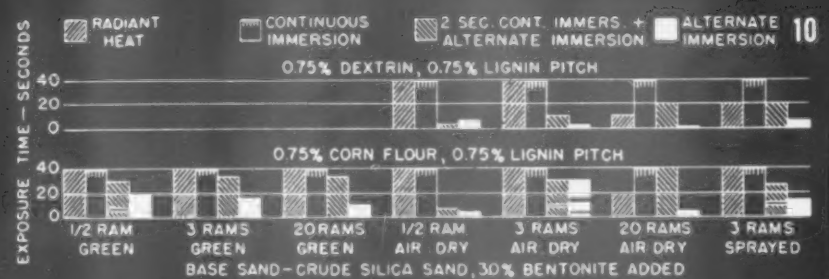


Fig. 10—Effect of combination of organic binders on behavior of sand in contact with liquid steel

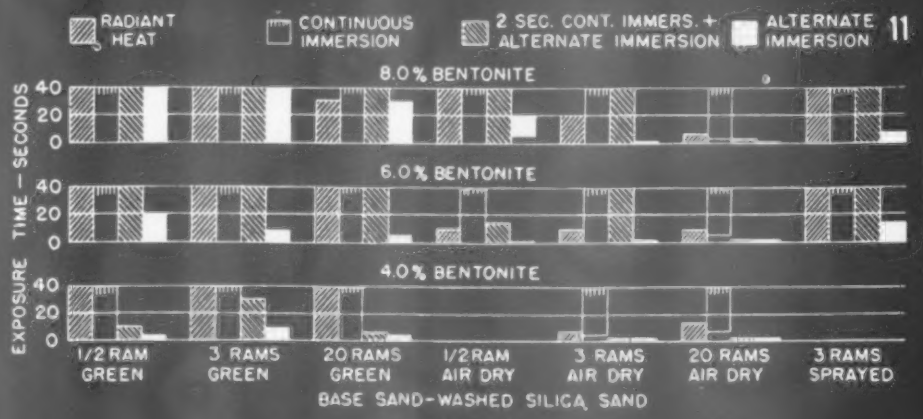


Fig. 11—Effect of bentonite content on behavior of sand in contact with liquid steel

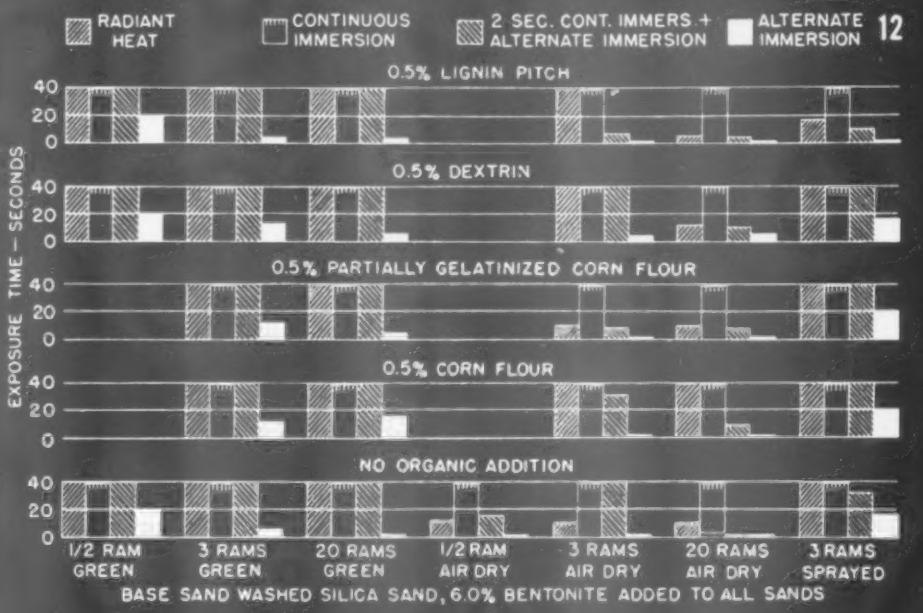


Fig. 12—Effect of organic additions on behavior of sand in contact with liquid steel

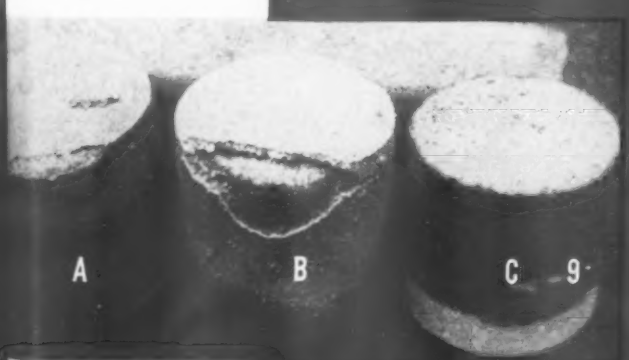
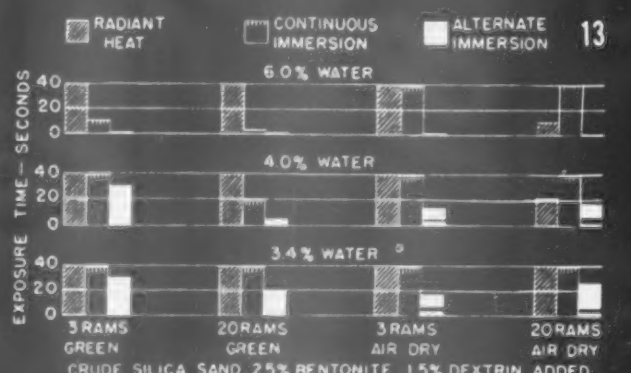
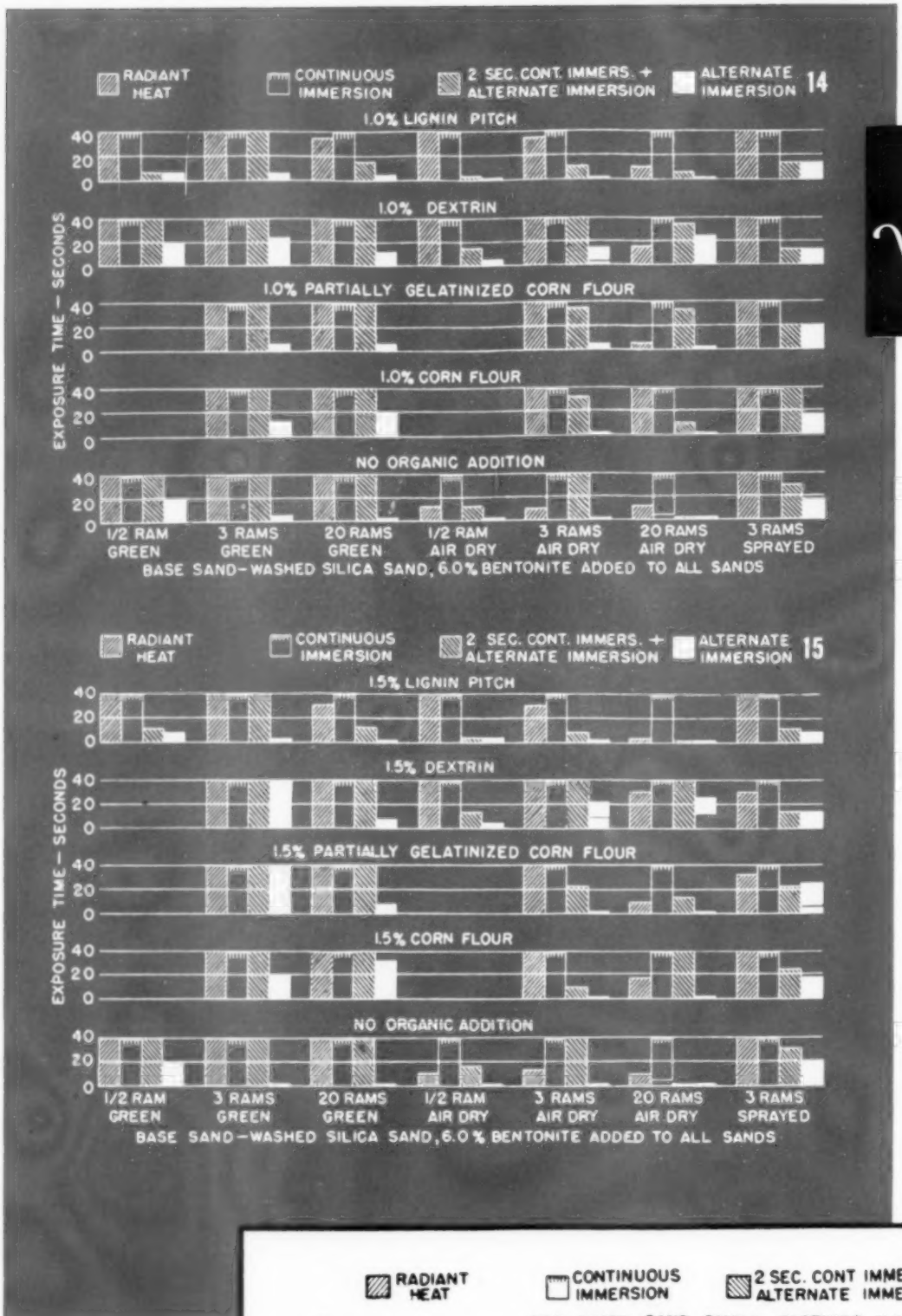


Fig. 13—Effect of increasing water content on behavior of a steel facing sand



Behavior of Molding Sand



Figs. 14 and 15—Effect of organic additions on behavior of sand in contact with liquid steel

Fig. 16—Comparison of behavior of new and reclaimed sand in contact with liquid steel

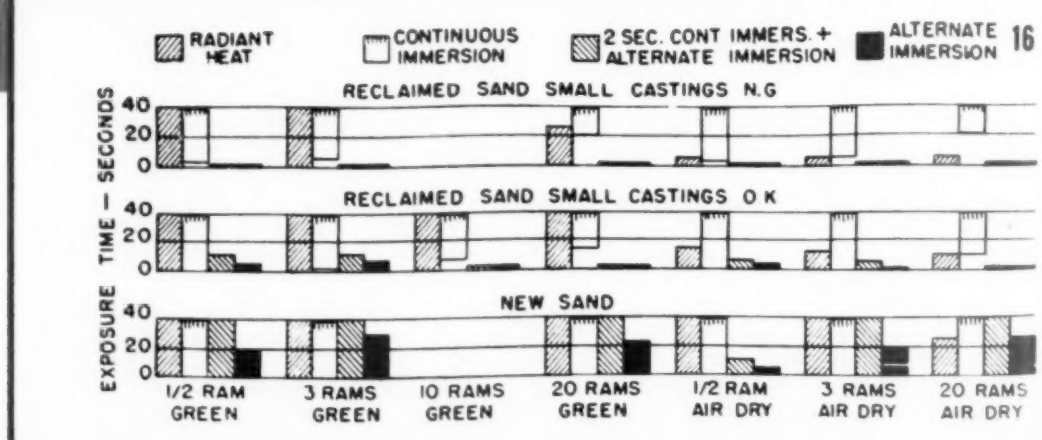


Fig. 17—Effect of ramming and air drying on three typical steel foundry facing sands

TABLE III

Type of Sand	AFA Fineness No.	Additions	% Water	No. of Rams	No. of Grams =2"	Green Permeability	Green Strength Psi	Green Hardness	Deformation in./2"	Air Dried Strength Psi	Air Dried Hardness
Crude	62	2.5% Bent. 1.5% Dextrin	3.2	½	137	430	3.4	58	.040	37	0
Crude	62	2.5% Bent. 1.5% Dextrin	3.2	3	155	180	7.8	81	.035	140	50
Crude	62	2.5% Bent. 1.5% Dextrin	3.2	20	170	65	18.5	93	...	290	90
Reclaimed	58	0.5% Bent. 0.5% Lignin	3.3	½	...	330	3.0	52	...	..	..
Small Cstgs.	OK	0.5% Bent. 0.5% Lignin	3.3	3	170	110	7.5	80	...	..	..
Small Cstgs.	OK	0.5% Bent. 0.5% Lignin	3.3	10	...	75	14.8	91	...	..	..
Small Cstgs.	OK	0.5% Bent. 0.5% Lignin	3.3	20	...	55	18.2	93	...	..	..
Reclaimed	60	0.5% Bent. 0.5% Lignin	3.5	½	145	300	3.1	50	...	43	0
Small Cstg. Scabbed											
Small Cstg. Scabbed		0.5% Bent. 0.5% Lignin	3.5	3	167	110	9.7	87	...	100	35
Small Cstg. Scabbed		0.5% Bent. 0.5% Lignin	3.5	20	182	45	24.0	95	...	140	63

TABLE IV

Washed Silica	65	4.0% Bent.	3.5	3	160	125	4.8	72	...	35	0
Washed Silica	65	4.0% Bent.	3.5	20	...	80	9.8	87	...	68	0
Washed Silica	65	6.0% Bent.	3.0	½	143	250	3.8	60	.022	30	0
Washed Silica	65	6.0% Bent.	3.0	3	157	120	7.6	79	.023	60	5
Washed Silica	65	6.0% Bent.	3.0	20	170	55	16.0	92	.023	102	33
Washed Silica	65	8.0% Bent.	3.9	½	143	260	4.3	57	.023	..	..
Washed Silica	65	8.0% Bent.	3.9	3	160	100	10.3	83	.016	..	..
Washed Silica	65	8.0% Bent.	3.9	20	175	42	23.0	94	...	..	..

tests are made to determine the behavior of sand when in contact with molten metal, in this case steel. Glazing of the sand, its resistance or susceptibility to erosion, scabbing, buckling and fusion can be studied. To date, the test has told nothing as to the sand's resistance to penetration or veining. A study of the latter two defects, using liquid steel, has been described by the author in a previous paper (J. B. Caine, "A Study of Burnt-on or Adhering Sand," *Transactions*, AFA, Vol. 51, p. 647). Of course, nothing can be told from these tests as to the hot strength or collapsibility of the sand.

PART I—CORRELATION OF THE TEST

Test Procedure—The method of studying behavior of sand in contact with molten metal is quite simple. If slag-free molten metal is available (as it must be in any foundry pouring small castings) the apparatus required is even simpler; the cost should not exceed $5, even in these times. All that is required are several dozen nuts with small brads tack-welded to them to act as arbors. These nuts are rammed up in standard AFA 2 in. diameter x 2 in. test specimens. The sand specimens can then be screwed to a rod and immersed in or subjected to molten metal in any number of ways to simulate conditions occurring in the mold as it is filled and for any length of time the sand is in contact with molten metal in the molds. Times can be controlled from a fraction of a second to minutes.

Details of the apparatus used to hold the sand specimens on rods are shown in Fig. 1.

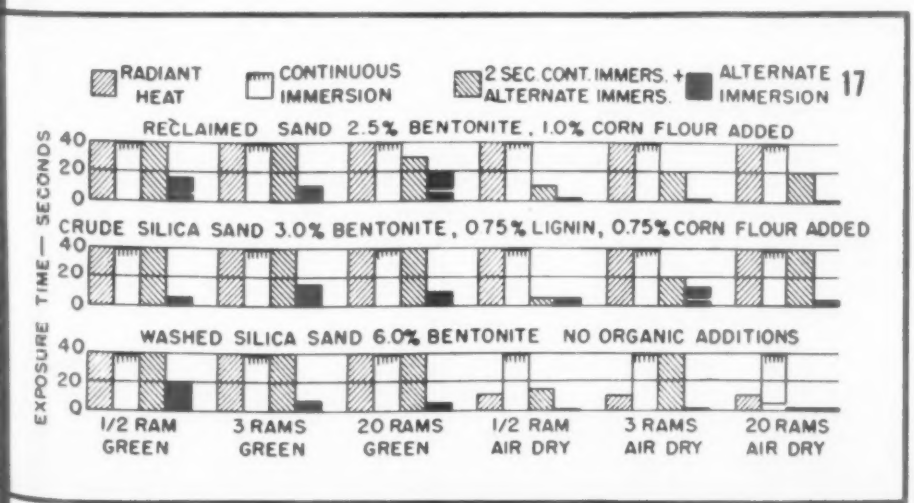
Any number of tests and combinations of tests can be made to simulate any condition occurring when a mold is poured, and while liquid metal is in contact with the mold surface. Five tests will be discussed in this paper, these having been selected as the most informative based on over a year's experience with the test.

1. Exposure to radiant heat by holding the sand specimen about ½-in. above the surface of molten steel. This test simulates the conditions prevailing at the cope mold surface while the mold is being filled.

2. Exposure to radiant heat as in (1) plus immersion in molten metal. This test simulates those conditions occurring when metal comes in contact with the cope mold surface after it has been exposed to radiant heat.

3. Continuous immersion (stationary metal). The standard AFA test specimen is immersed in molten steel to a depth of about 1¾ in. and withdrawn at stated time intervals. A new specimen is used for each time interval. This test simulates the behavior of sand in contact with steel in mold locations where there is little or no metal flow over the sand.

4. Alternate immersion (flowing metal). The standard AFA test specimen is (*Please turn to page* 143)



Malleable Founders

Mark 50th Anniversary

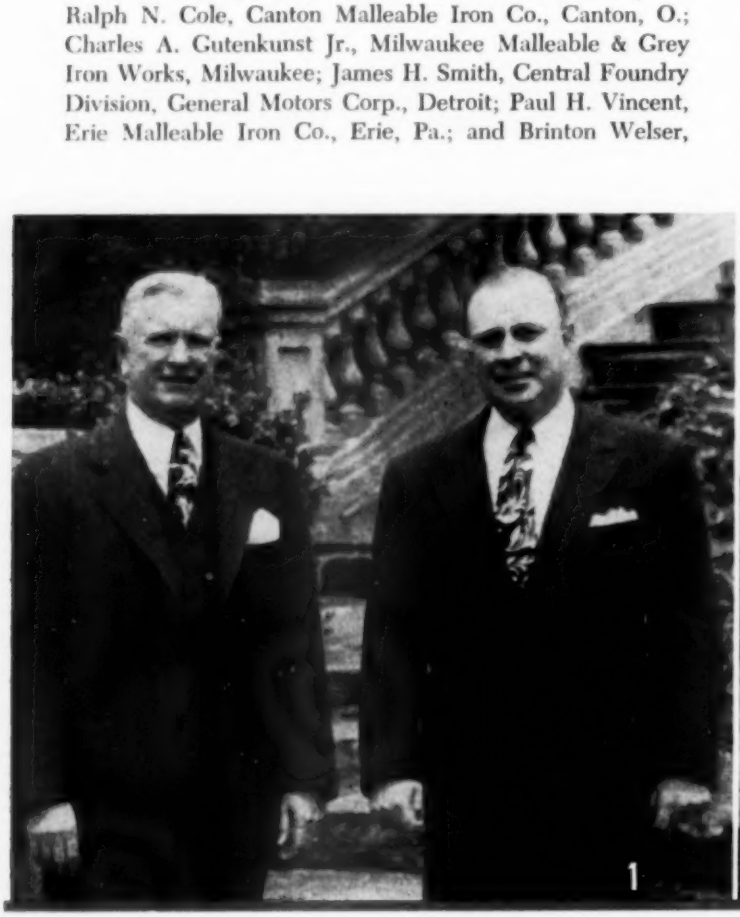
ONE of the most successful annual meetings in the history of the Malleable Founders' Society was held at the Homestead, Hot Springs, Va., June 5 and 6. This meeting marked the 50th anniversary of the founding of the malleable group which was a predecessor of the present malleable society. Two business sessions and an annual dinner were high lights of the meeting, which was attended by an exceptionally large representation of member companies.

Frank E. Shumann, president, Lehigh Foundries, Inc., and president of the Malleable Founders' Society, presided. Presidents of the various trade and technical associations of the foundry industry had been extended invitations to attend, and during the session Mr. Shumann introduced Max Kuniansky, president-elect and Sheldon V. Wood, retiring president of the American Foundrymen's Association.

The new board of directors was announced as follows: Western section, Cal C. Chambers, Texas Foundries Inc.; Ralph N. Cole, Canton Malleable Iron Co., Canton, O.; Charles A. Gutenkunst Jr., Milwaukee Malleable & Grey Iron Works, Milwaukee; James H. Smith, Central Foundry Division, General Motors Corp., Detroit; Paul H. Vincent, Erie Malleable Iron Co., Erie, Pa.; and Brinton Welser, Chain Belt Co., Milwaukee. Eastern section, Frank D. Brisse, Laconia Malleable Iron Co., Laconia, N. H.; Harry M. Laws, New Haven Malleable Iron Co., New Haven, Conn.; Frank E. Shumann, Lehigh Foundries Inc., Easton, Pa.; and Ken M. Smith, Lancaster Malleable & Steel Corp., Lancaster, N. Y.

At a meeting of the new board of directors held during the annual meeting the following officers were named: President, William H. Moriarty, National Malleable & Steel Castings Co., Cleveland; vice president, Collins L. Carter, Albion Malleable Iron Co., Albion, Mich.; executive vice president, H. L. Colby; secretary-treasurer, John J. Harant; and consulting engineer, James H. Lansing.

The annual Charles H. McCrea Medal and Certificate of Award were officially presented to the society by Cleve H. Pomeroy, president, National Malleable & Steel Castings Co., Cleveland. In making this presentation, Mr. Pomeroy paid high tribute to Mr. McCrea's many contributions to the strengthening of the malleable industry and to the development of his company. With these contributions in mind, the board of directors of the National Malleable & Steel Castings Co. recently created a permanent memorial in his (*Please turn to page* 228)



1

By FRANK G. STEINEBACH
Editor
THE FOUNDRY

Fig. 1—William H. Moriarty (left), National Malleable & Steel Castings Co., Cleveland, and Collins L. Carter, Albion Malleable Iron Co., Albion, Mich., newly elected president and vice president, respectively, of the Malleable Founders' Society

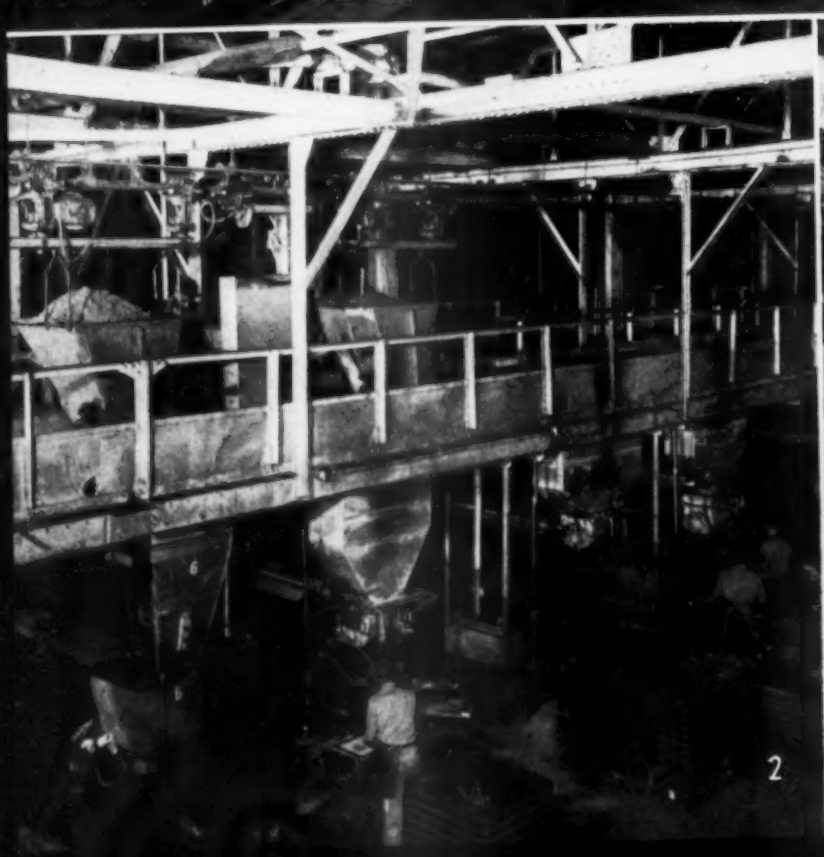
Fig. 2—Frank E. Shumann (right), Lehigh Foundries Inc., Easton, Pa., and retiring president of the society, officially accepts for the organization the recently created annual Charles H. McCrea Medal and Certificate of Award from Cleve H. Pomeroy, president of the award's sponsor, National Malleable & Steel Castings Co.

Fig. 3—John T. Llewellyn, (left), chairman, Chicago Malleable Castings Co., only surviving founding member of the American Malleable Castings Association, and Cal C. Chambers, Texas Foundries Inc., Lufkin, Tex.

Fig. 4—Left to right: James H. Lansing, consulting engineer; Robert E. Belt, retired secretary-treasurer of the society; Frank E. Schumann, retiring president; George E. Bean, Eastern Malleable Iron Co., Wilmington, Del., first recipient of the Charles H. McCrea Gold Medal

Fig. 5—General view of participants in the annual meeting at Hot Springs, Va.

1



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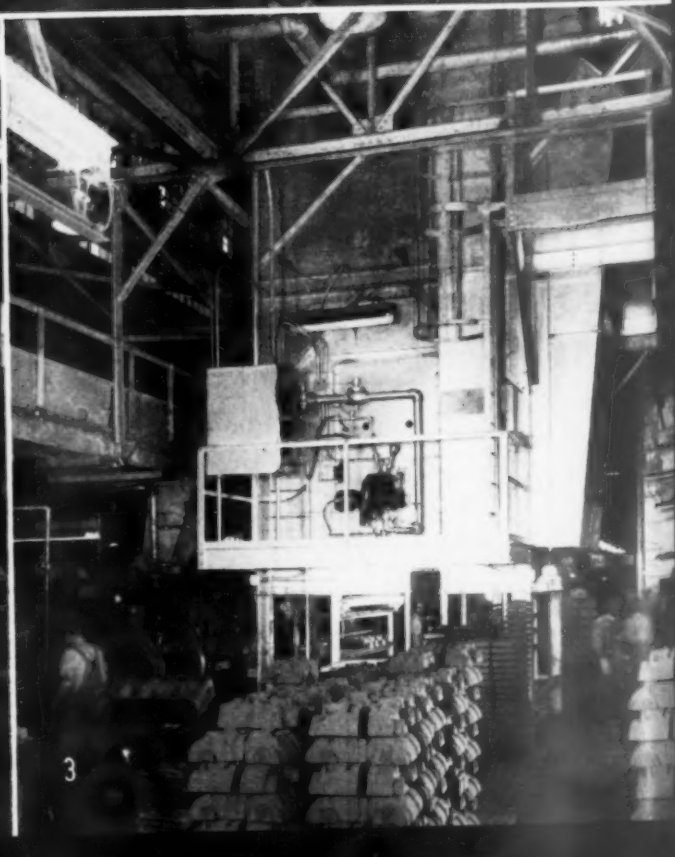


3

Automotive Foundry

ENGINEERED ON ASSEMBLY LINE PATTERN

WORKING conditions approaching those to be found in the modern machine shop and on the assembly line have been achieved by the Cadillac Motor Car Division in its rebuilt and expanded gray iron foundry.

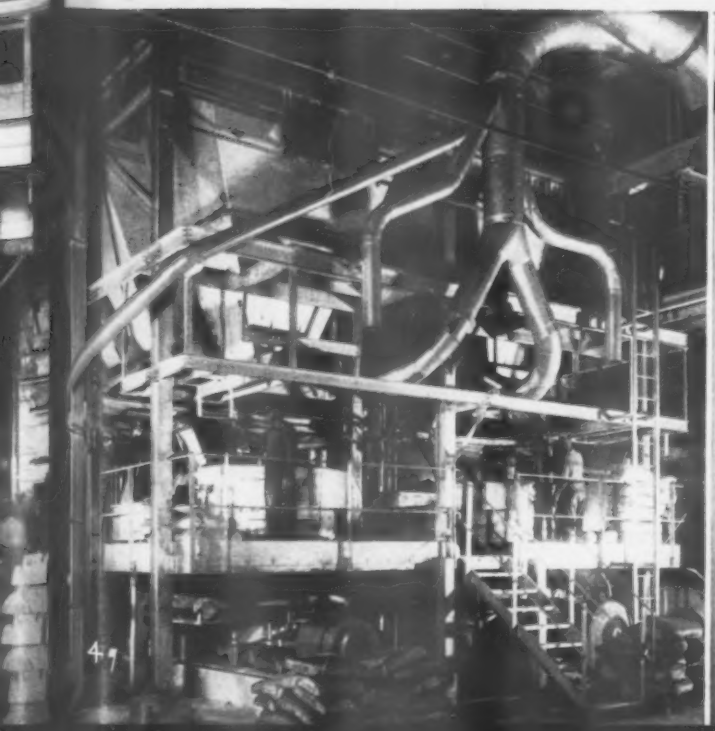
"In designing this foundry, the health and well-being of employees and the minimum expenditure of human energy for efficient operation were kept uppermost in our minds," according to C. A. Raftrey, works manager. "In following our casting processes through the foundry, it will be noted that wherever possible heavy manual labor has been eliminated. Furthermore, the ventilation system was designed to provide the maximum of clean air for the health of employees. Smoke, gas and dust are drawn away from pouring zones and shakeout locations by specially-designed equipment, keeping the air as clear as possible. The court roofs in the foundry were raised to a height which gives the best heat reduction, ventilation and light. We have provided lacker rooms which are second to none in the industry. And ample bath and shower facilities are at the disposal of the employees."

The reconstruction of Cadillac's foundry is the aftermath of peak operation throughout the war, which allowed no time for shutdowns and major repairs for four years. The foundry was left in a condition which hampered the postwar automobile schedule.

In modernizing, the capacity of the Cadillac foundry was greatly expanded to take care of some of the needs of other General Motors divisions. It was also necessary to modernize the old foundry to attract the kind of personnel desired. The result is a foundry designed and equipped to eliminate drudgery and health hazards in every possible way.

Cadillac's old foundry was situated advantageously to the plant as a whole. Therefore, it was decided to build the new foundry in the same area. Remarkably, this was accomplished without suspending operations.

The new foundry was engineered strictly on the assembly line pattern to provide the benefits to be obtained from progressive operation. All phases of the operations



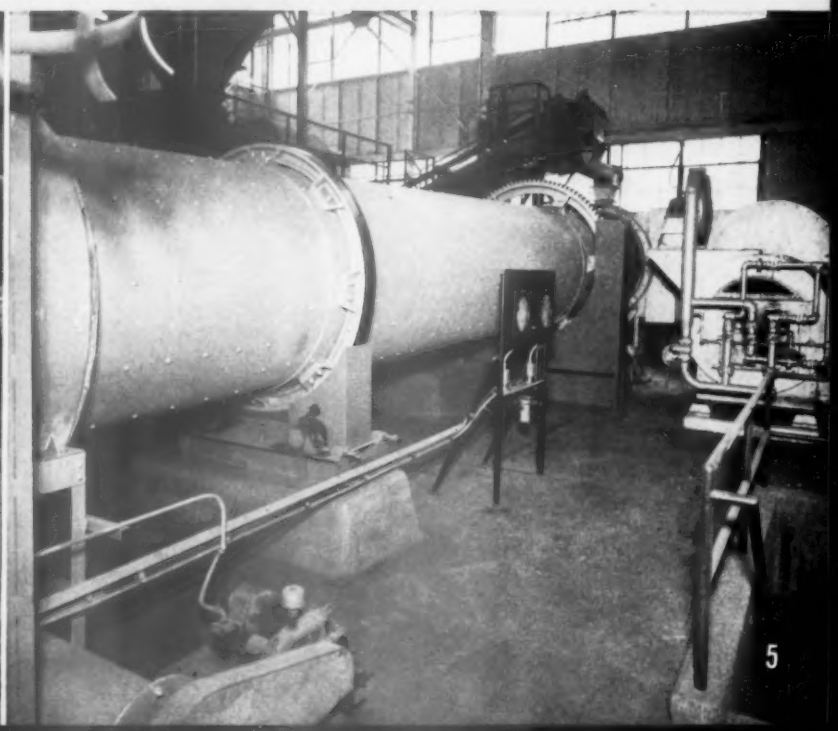


Fig. 1 — Setting and gaging cores for cylinder crankcase at Cadillac Motor Car gray iron foundry

Fig. 2 — Sand delivery in coreroom

Fig. 3 — Vertical core-baking oven

Fig. 4—Mixers for supplying sand to soft iron molding lines

Fig. 5—Drier and heater in sand reclamation room

New Automotiv Fou

Fig. 6 — Pouring castings on soft iron molding line

Fig. 7 — Molding drag for cylinder crankcase with sandslinger

Fig. 8 — Making green sand cores with sandslinger

Fig. 9 — Pouring cylinder crankcases on mold conveyor

...tive Foundry

were planned and engineered for balanced capacity. And, wherever possible, control is automatic and human activity is reduced.

This is the way the assembly line technique works in Cadillac's new foundry. Raw materials, provided with ample rail facilities, are received and stocked at the west end of the foundry buildings. New sand storage buildings, holding 8000 tons of sand, have unloading facilities at either end of the storage bins. Equipment for drying the sand is installed directly back of the coreroom.

An operator at a control panel in the sand mixing room draws sand from the drier and conveys it to the holding hopper in the mixing department. The control panel also governs the flow of oil from the core oil tanks, installed outside the building, to a reserve tank in the mixing room. These ingredients, along with corn flour, kerosene and water, are metered automatically for final mixing prior to delivery to the core department.

Fig. 10 — Tapping cupola into receiving ladle and filling hot metal crane ladle

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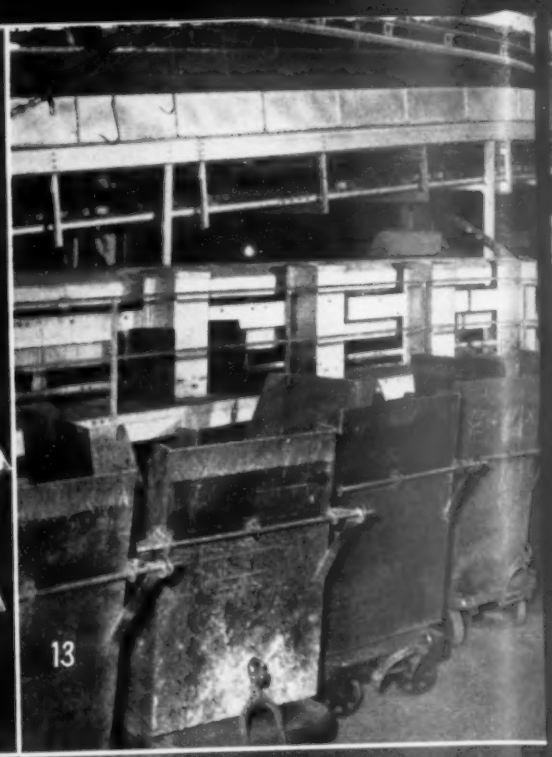
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New Automotive

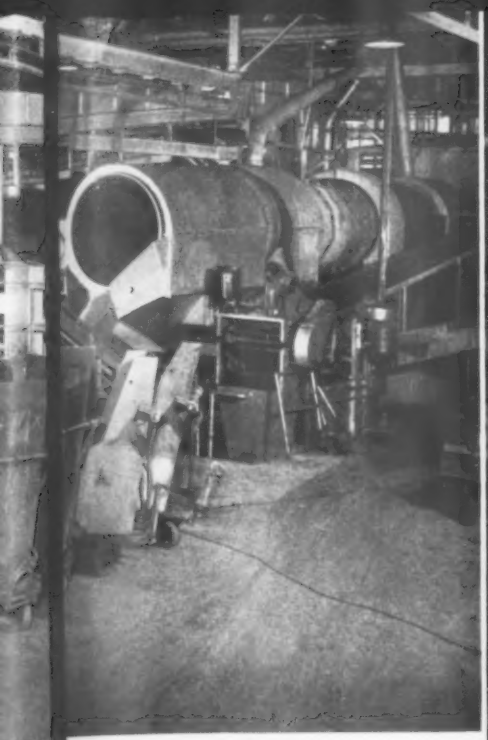


Fig. 11 — Cylinder crankcase castings being loaded into stress relieving furnace

Foundry

Fig. 12—Cylinder crankcases entering blasting cabinet

Fig. 13—Inclined cooling conveyor in background; sorting conveyor in foreground; wet cleaning mill at right

Fig. 14—Unloading small castings from airless blast unit

Fig. 15 — Loading coke into weigh car

When finally mulled, the sand is released from the mixer and carried on a distributing belt to the storage hoppers. There a tramrail operator obtains sand for core blowing machines and delivers it to hoppers above the machines.

After cores are blown, spilled sand falls through a grating into a tunnel, which returns unused sand to a newly installed sand reclamation system. All but a small percentage of the sand is reclaimed and reconditioned for use again.

Cores are baked and dried in continuous horizontal and vertical ovens.

Rail facilities also are provided for scrap metal, pig iron and unloading of coke in container cars. In emergencies carloads of coke can be dumped into hoppers beneath the tracks and elevated to coke bins.

An electromagnet on a 10-ton bridge crane unloads scrap and pig iron in storage bins. Limestone is dumped into hoppers under the railroad tracks. Seacoal, bentonite, (*Please turn to page* 240)

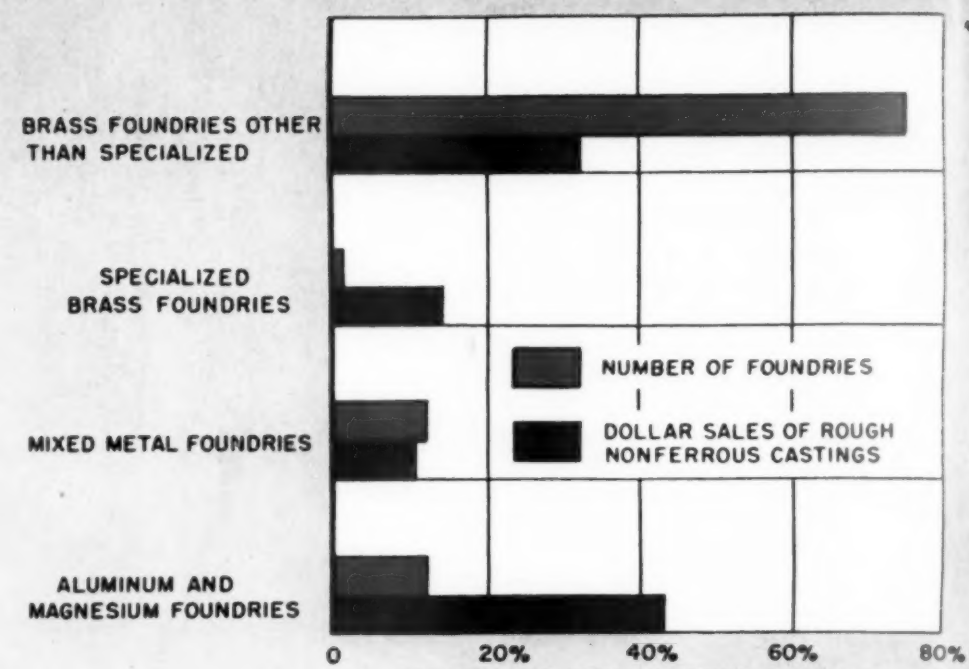


Fig. 1 (right)—Percentage distribution, by class of foundry, of nonferrous foundries and dollar sales of rough nonferrous castings, first half 1942

Fig. 2 (far right)—Percentage distribution, by size of foundry, of single-line and multiple-line sellers of rough nonferrous castings, first half 1942

THE NONFERROUS FOUNDRY IN

Its Structure, Sales, Costs and Profits

TABLE I—Distribution by Class of Foundry of Reporting Nonferrous Foundries*/ and Dollar Sales of Rough Nonferrous Castings, First Half 1942

Class of Foundry**	Number of Companies	Dollar Sales (millions)	Percentage Distribution Number of Companies	Dollar Sales
Brass foundries:				
Specialized foundries: makers of railway journal bearings or ship propellers	13	$ 25.9	1%	14%
Other brass foundries	987	61.1	75	32
Mixed metal foundries	157	21.2	12	11
Aluminum and magnesium foundries	162	82.6	12	43
All foundries	1,319	190.8	100	100

* Reporting foundries represented more than 90% of all commercial nonferrous foundries operating in period, and handled an even greater percentage of total sales.

** Companies were classified as brass, aluminum or magnesium foundries if 75% or more of total dollar sales of rough nonferrous castings were in one of these metals. "Mixed metal" foundries are those selling significant proportions of both brass and light metal castings.

Source: O.P.A. Form 125-10 (classification questionnaire)

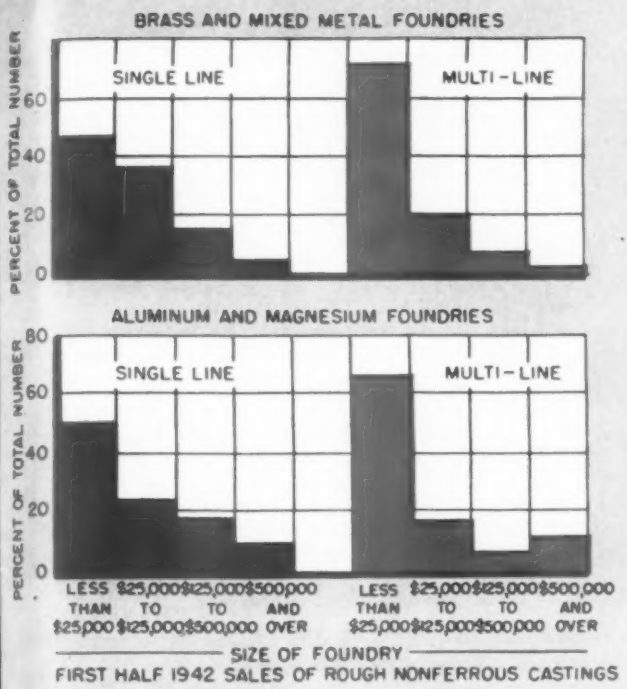
THIS ARTICLE, in three parts, discusses statistics of the commercial nonferrous foundry industry soon to be released by the Office of Temporary Controls, successor to the Office of Price Administration. The OPA through a series of surveys gathered valuable information on the structure of the industry and wartime developments in sales, costs and profits, such as was needed for guidance in price control problems. Companies which participated in these questionnaire surveys made real sacrifices in time and effort, particularly the 300 foundries selected as a representative sample of the industry and asked to file detailed reports on sales and costs. In issuing the

TABLE II—Distribution by Size of Foundry of Reporting Single-line and Multiple-line Sellers * of Rough Nonferrous Castings, First Half 1942

Size of Foundry	Single-line sellers		Multiple-line sellers		All sellers	
Number of companies	Brass and Mixed Metal Foundries	Aluminum and Magnesium Foundries	Brass and Mixed Metal Foundries	Aluminum and Magnesium Foundries	Brass and Mixed Metal Foundries	Aluminum and Magnesium Foundries
Sales of rough nonferrous castings in first half 1942:						
Less than $25,000	299	52	357	38	656	90
$25,000—$50,000	110	11	49	7	159	18
$50,000—$125,000	128	12	51	7	179	15
$125,000—$250,000	60	14	19	7	79	16
$250,000—$500,000	39	5	14	7	53	7
$500,000 and over	18	9	13	7	31	16
All size groups	654	103	503	59	1157	162
Percentage distribution						
Sales of rough nonferrous castings in first half 1942:						
Less than $25,000	46%	50%	71%	65%	57%	56%
$25,000—$50,000	17	11	10	12	14	11
$50,000—$125,000	19	12	10	5	15	9
$125,000—$250,000	9	13	4	3	7	10
$250,000—$500,000	6	5	3	3	4	4
$500,000 and over	3	9	2	12	3	10
All size groups	100	100	100	100	100	100

* A company was classified as a multiple-line seller if products other than rough nonferrous castings accounted for as much as 25% of total dollar sales. Reporting foundries represent more than 90% of all commercial nonferrous foundries operating in period.

Source: O.P.A. Form 125-10



Y INDUSTRY—

By JOSEPH B. MEIER
and
VIRGINIA H. McCLUNG
Washington

present analysis, the authors wish to commend these companies as well as the two industry advisory committees and their two chairmen, Edwin W. Horlebein, president, the Gibson & Kirk Co., Baltimore, and L. E. DeGroat, sales manager, the Permold Co., Medina, O.

Structure of the Industry—Real and substantial opportunities for small enterprise exist in the nonferrous foundry industry. Sand mold casting is a process which ceases to be economical when metal parts are needed in quantity and are simple enough in design to be suited to any of the mass production methods used in the metals field. Since this tends to place an automatic limit on the size of the industry's units, the nonferrous foundry industry is built around hundreds of small and medium-size establishments located in industrial centers to serve the needs of a moderate number of local customers. In certain fields, where there are special requirements in techniques and equipment and peculiar circumstances in demand, larger companies appear; but while these companies handle the major part of the industry's sales, they hardly exceed the small jobbing foundries in their importance to the national economy or the profitableness of their operations.

Metal Specialty Classes—Several segments in the industry are, in a sense, distinct industries in themselves. Brass, aluminum and magnesium foundries are sufficiently unlike in the character of their operations, history of their development and the influences to which they are subjected that they must be treated as separate groups for many purposes. However, the lines of demarcation are not clear-cut.

Few foundries handle one class of metal solely and a large number have their production so divided between two or more classes of metal that no single class can be said to predominate. Of approximately 1500 commercial nonferrous foundries operating the first half of 1942, about 75 per cent specialized in copper or copper-base metals and somewhat more than 10 per cent specialized in the light metals—aluminum and magnesium. A company was said to specialize in a metal if 75 per cent or more of dollar sales of rough nonferrous castings was in such metal. (The term "rough nonferrous castings" is used in this report to refer to both rough castings and semimachined castings—those whose cost of machining does not exceed 25 per cent of total costs. These were, in general, the castings which were subject to Revised Maximum Price Regulation No. 125). The balance could only be classified as a "mixed metal" group, producing both brass and aluminum. A very few companies specialized in nickel, zinc or other nonferrous metals, but such companies are omitted from the statistics presented in this report.

When dollar volume of sales is considered instead of number of companies, the relative importance of these classes of foundries appears in a different light. Aluminum and magnesium foundries accounted for almost

TABLE III—Distribution by Size of Foundry of Reporting Nonferrous Foundries * and Dollar Sales of Rough Nonferrous Castings, First Half 1942

Size of Foundry	Brass and Mixed —Metal foundries— Number of Companies	Brass and Mixed —Metal foundries— Sales (millions)	Aluminum and —Magnesium Foundries— Number of Companies	Aluminum and —Magnesium Foundries— Sales (millions)	—All Foundries— Number of Companies	—All Foundries— Sales (millions)
Sales of rough nonferous castings in first half 1942:						
Less than $25,000	656	$ 4.8	90	$ .7	746	$ 5.5
$25,000—$50,000	159	5.7	18	.6	177	6.3
$50,000—$125,000	179	14.4	15	1.2	194	15.6
$125,000—$250,000	79	13.9	16	2.7	95	16.6
$250,000—$500,000	53	17.1	7	2.5	60	19.6
$500,000 and over	31	52.3	16	74.9	47	127.2
All size groups	1157	108.2	162	82.6	1319	190.8
Percentage distribution Sales of rough nonferrous castings in first half 1942:						
Less than $25,000	57%	5%	56%	1%	57%	3%
$25,000—$50,000	14	5	11	1	13	3
$50,000—$125,000	15	13	9	1	15	8
$125,000—$250,000	7	13	10	3	7	9
$250,000—$500,000	4	16	4	3	4	10
$500,000 and over	3	48	10	91	4	67
All size groups	100	100	100	100	100	100

* See footnote 1 of Table I. Source: OPA Form 125-10

TABLE IV—Distribution by Size of Foundry of Companies and Dollar Sales of Rough Nonferrous Castings Subject to Pricing Provisions of RMPR 125, 1943

Size of Foundry	Brass and Mixed —Metal Foundries— Number of Companies	Brass and Mixed —Metal Foundries— Sales (millions)	Aluminum and —Magnesium Foundries— Number of Companies	Aluminum and —Magnesium Foundries— Sales (millions)	——All Foundries—— Number of Companies	——All Foundries—— Sales (millions)
1943 sales of rough nonferrous castings:						
Less than $100,000	186	$ 11.8	29	$ 1.5	215	$ 13.3
$100,000—$250,000	235	37.9	23	3.7	258	41.6
$250,000—$500,000	107	38.4	18	6.4	125	44.8
$500,000—$1,000,000	56	39.2	17	12.4	73	51.6
$1,000,000 and over	43	149.0	38	290.0	81	439.0
All size groups	627	276.3	125	314.0	752	590.3
Percentage distribution 1943 sales of rough nonferrous castings:						
Less than $100,000	30%	4%	23%	1%	28%	2%
$100,000—$250,000	37	14	19	1	34	7
$250,000—$500,000	17	14	14	2	17	8
$500,000—$1,000,000	9	14	14	4	10	9
$1,000,000 and over	7	54	30	92	11	74
All size groups	100	100	100	100	100	100

Source: OPA Forms 677-668 "Report from Foundries Subject to RMPR 125" and 677-669 "Report on Sales by Foundries Subject to RMPR 125. Estimates added for companies failing to file these forms.

TABLE V—Percentage Distribution, by Dollar Sales of Rough Nonferrous Castings and of All Products, of Companies Subject to Pricing Provisions of RMPR 125, 1943

Sales Group	Brass and Mixed Metal Foundries	Aluminum and Magnesium Foundries	All Foundries
1943 sales of rough nonferrous castings:			
Less than $100,000	30%	23%	28%
$100,000—$250,000	37	19	34
$250,000—$500,000	17	14	17
$500,000—$1,000,000	9	14	10
$1,000,000 and over	7	30	11
All groups	100	100	100
1943 sales of all products:			
Less than $100,000	18%	12%	17%
$100,000—$250,000	33	13	30
$250,000—$500,000	20	16	19
$500,000—$1,000,000	13	15	13
$1,000,000 and over	16	44	21
All groups	100	100	100

Source: OPA Forms 677-668 and 677-669, with estimates added for companies failing to file these forms.

TABLE VI—Percentage Distribution by Geographic Area of Nonferrous Foundries and Dollar Sales of Rough Nonferrous Castings, 1943

Area and State	Distribution of Number of Companies Foundries Subject to Pricing Provisions of RMPR 125: Brass and Mixed Metal Foundries	Aluminum and Magnesium Foundries	Exempt Foundries	Distribution of Dollar Sales: All Foundries	All Foundries
New England	13%	6%	11%	11%	9%
Connecticut	5	5	2	3	6
Massachusetts	6	1	5	5	2
Other states[1]	2	..	4	3	1
Middle East	30	16	25	26	23
New Jersey	6	4	5	5	4
New York	11	10	9	10	11
Pennsylvania	11	2	9	9	7
Other states[2]	2	..	2	2	1
Central	41	49	30	37	56
Illinois	9	8	5	7	8
Michigan	9	12	5	7	16
Missouri	2	3	2	2	7
Ohio	12	16	8	11	19
Wisconsin	4	5	4	4	3
Other states[3]	5	5	6	6	3
Far West	11	23	12	13	7
California	9	22	7	9	6
Other states[4]	2	1	5	4	1
All other areas	5	6	22	13	5
All areas	100	100	100	100	100

Note: In a small number of cases individual companies operate plants in various states. In this table, each such plant is treated as a separate company.

[1] Maine, New Hampshire, Rhode Island and Vermont.
[2] Delaware, District of Columbia, Maryland and West Virginia.
[3] Indiana, Iowa and Minnesota.
[4] Nevada, Oregon and Washington.

Source: For subject foundries, OPA Forms 677-668 and 677-669. For exempt foundries, OPA Form 115a, "Report on Net Sales for All Nonferrous Foundries Selling Less than $12,500 of Nonferrous Castings in the Preceding Quarter."

45 per cent of the industry's total sales of rough nonferrous castings in the first half of 1942. This understates the proportion of total sales represented by aluminum and magnesium castings, since a sizable amount of such castings was also sold by the mixed metal foundries, a group reporting a little more than 10 per cent of the industry's total dollar sales. A handful of brass foundries, those specializing in the production of ship propellers or railway journal bearings, contributed another 14 per cent of total dollar sales. Brass foundries other than these specialized producers, a group representing three-quarters of the total number of commercial foundries, accounted for less than one-third of sales. Table I and Fig. 1 indicate the importance of the various classes of foundries in the first half of 1942, measured first by number of companies and then by dollar sales.

A still different appraisal of the importance of the several classes of foundries would be obtained if pound sales were used as the standard. Because aluminum has one-third the weight of copper and magnesium is still lighter, a direct comparison of tonnages sold by each class is misleading, however. The physical volume of sales of brass foundries exceeds that of aluminum or magnesium foundries, but not to the extent shown by unadjusted tonnage figures.

In the brass and bronze castings field, small companies predominate. This is largely explained by the fact that there are no great obstacles to opening and operating a brass foundry. Because the casting of heavy metals is an old and relatively simple art, and because the brass castings required by American industry are normally reasonable in design and tolerant in specification, a company can operate in this field without large investment in equipment, labor force or technical controls.

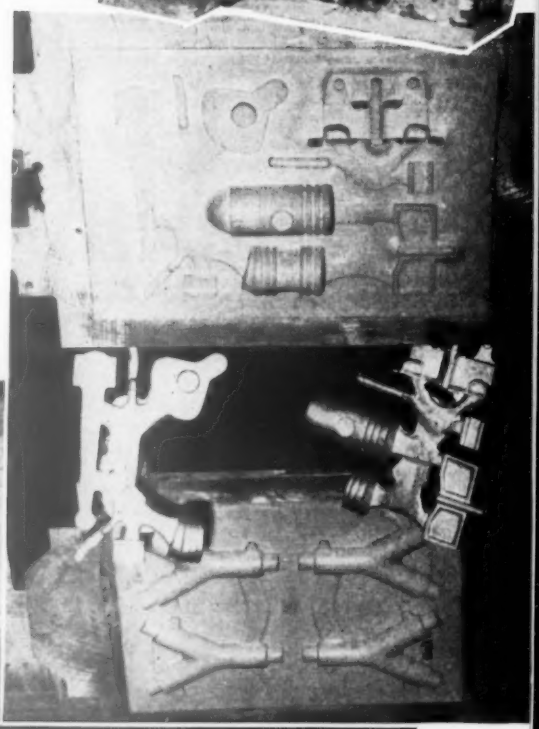
For the same reason, users of brass castings need depend upon outside suppliers only insofar as it is advantageous to do so and the opportunities for commercial brass foundries are limited largely to jobbing work, a type of work at which small companies are ordinarily at no competitive disadvantage. In fact, a buyer often finds himself best served by a small local producer who is familiar with his needs, able to give quick and inexpensive delivery, and prepared to grant special services as an accommodation. Few (*Please turn to page* 138)

By ROBERT H. HERRMANN
Assistant Editor
THE FOUNDRY

Plastic Patterns

PLASTIC patterns are making their bid for a place in the foundry. Durability, minimum shrinkage, ease of draw and economy are some of the qualities claimed for these patterns, which bid fair to provide for the application of these production tools along with the more familiar wood and metal patterns.

The Plastic Corp. of Chicago, 2444 South Central Ave., Cicero 50, Ill., has been experimenting with the use of phenol formaldehyde casting resin—basic ingredient in plastic patterns—for the last 3½ years, and for the last 2 years has been turning out plastic matchplates and master pattern duplicates which have been used in production by many foundries and manufacturers in the Middle West. (*Please turn to page* 232)



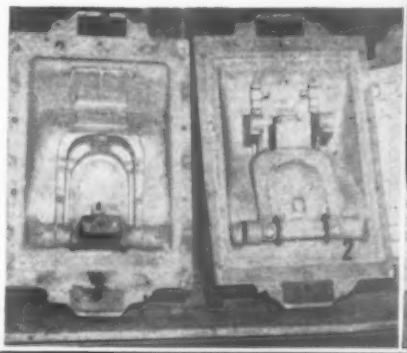
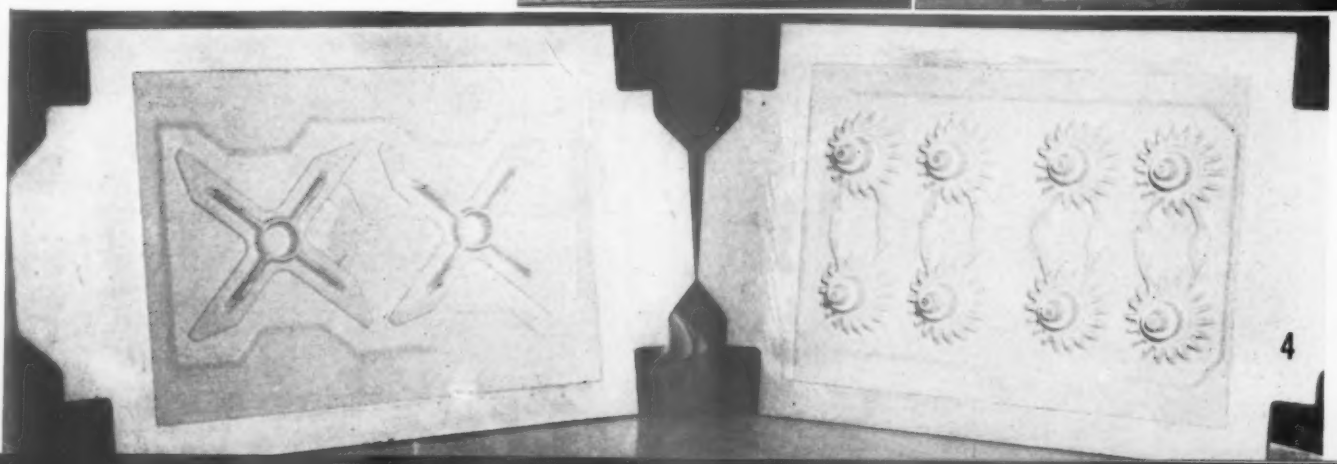


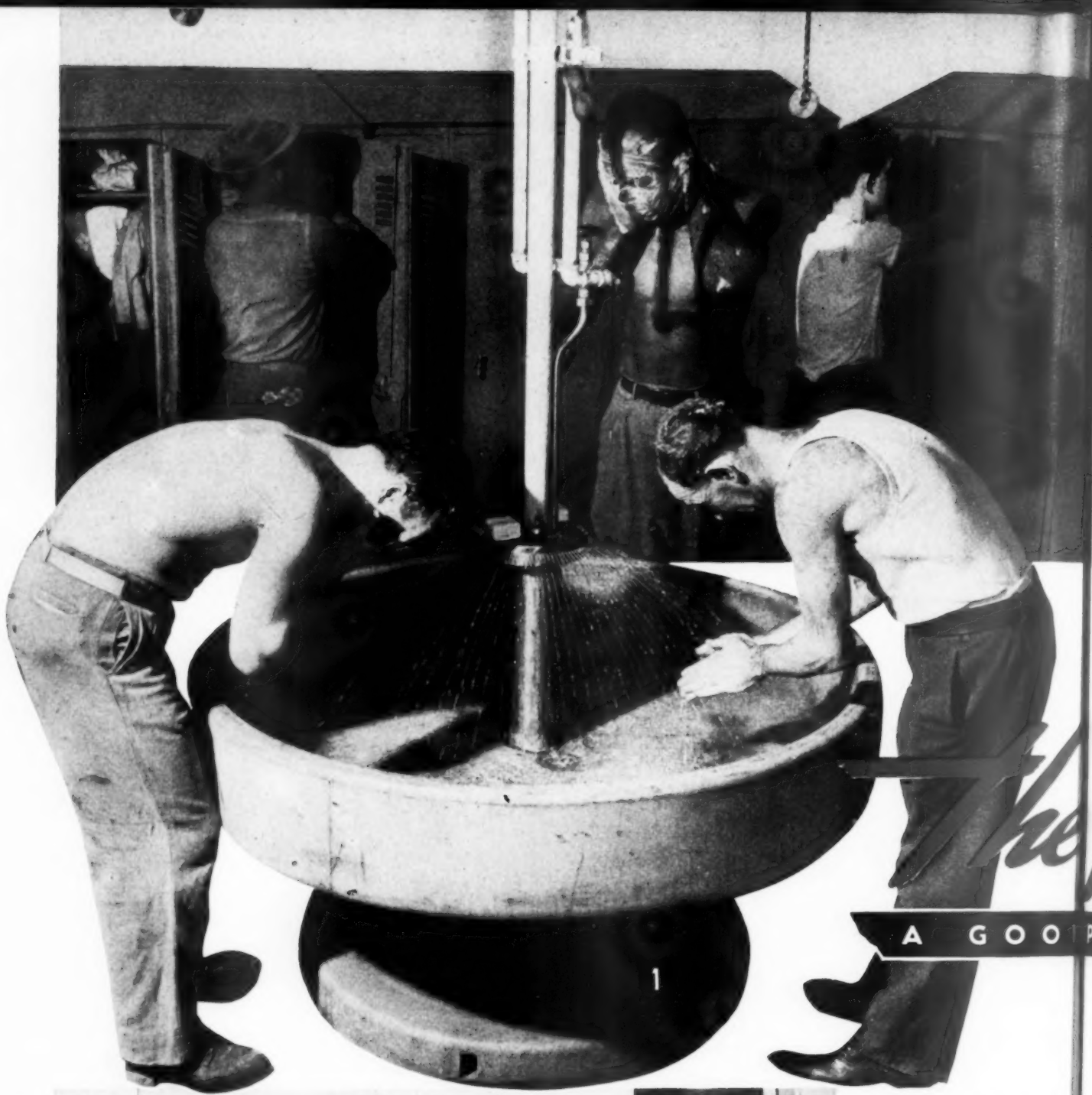
Fig. 1—Ladd Salach, president, Plastic Corp. of Chicago, is shown examining 36 x 36 in. plastic cope and drag sections

Fig. 2—These two plastic matchplates have produced over 4000 molds

Fig. 3—Castings produced from a mold made by the top plate are shown

Fig. 4—Two conventional new plastic matchplates

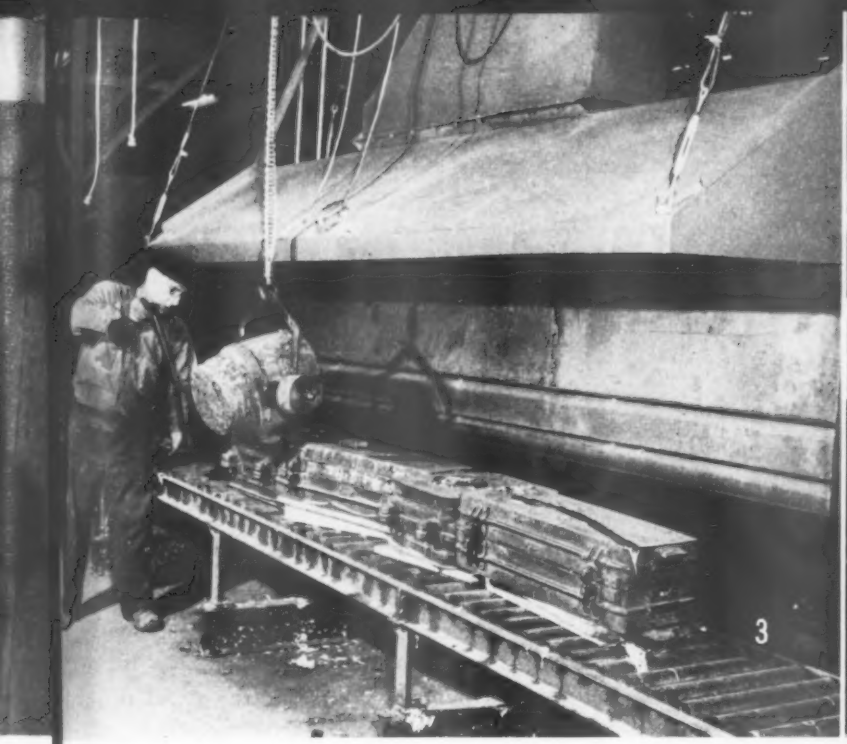




Figs. 1 and 2—Providing of adequate wash room and medical facilities were major steps in the foundry modernization program of United States Rubber Co.'s Shoe Hardware Division, Waterbury, Conn.

Fig. 3 — An efficient exhaust system controls dust, smoke and heat at the pouring station

Fig. 4—One of the plant's two 400-lb capacity aluminum melting furnaces



By LOUIS W. WOODHOUSE
Principal Industrial Hygiene Engineer
Bureau of Industrial Hygiene
Connecticut State Department of Health

Foundry PLACE TO WORK

This paper comprised the Lupian S. Brown Lecture of the seventh New England Foundry Conference held in Cambridge, Mass., Mar. 28-29. Mr. Brown, in whose honor the lecture was presented, for many years was president of the Springfield Facing Co.

CONTINUED evidence indicates that, despite its heavy production, the foundry industry cannot satisfy the postwar demand for castings. This situation could be alleviated in a large measure if more foundry employees could be obtained. Many employment managers appear to have taken the view that only old foundry workers, or men who cannot obtain other jobs, will apply for work. They take the position that foundries in general are not attractive places of employment and that substandard environmental conditions relative to health, safety, lighting, noise, and sanitary facilities must be taken for granted by a prospective employee. However, a growing number of forward-looking foundrymen believe that working conditions can be so improved that workmen will readily seek the opportunity to learn the trade in their foundries.

In adopting this opinion, management must be prepared to make major changes involving a considerable outlay of funds for plant modernization including mechanization of some processes. Such an outlay of funds can be contemplated only on the basis of a reasonable increase in production accompanied by a lowered unit cost of castings. In the past few years several Connecticut establishments have successfully modernized their gray iron, malleable iron, or nonferrous foundries. The latest plant to complete the changeover is the Shoe Hardware Division of the United States Rubber Co. at Waterbury, Conn., which operates an aluminum foundry for the production of rubber footwear lasts and similar castings.

Since many of the management-labor problems, as well as mechanized processes, are parallel in all types of foundries, an outline of problems and the means taken by this company to obtain the desired results are of interest.

Early in 1944 it became apparent that it would be practically impossible to keep abreast of production requirement without expanding the foundry area and hiring additional workers. Both of these possibilities were found impracticable because adjoining plant areas were not to be had, and those new workers who were available in a tight labor market were not interested in foundry work.

At this time the Bureau of Industrial Hygiene of the Connecticut State Department of Health was called in to undertake air studies to determine the extent of the industrial health hazards. These studies resulted in the presentation of certain recommendations for the use of personal protective equipment and the improvement of exhaust ventilation for control of atmospheric dust.

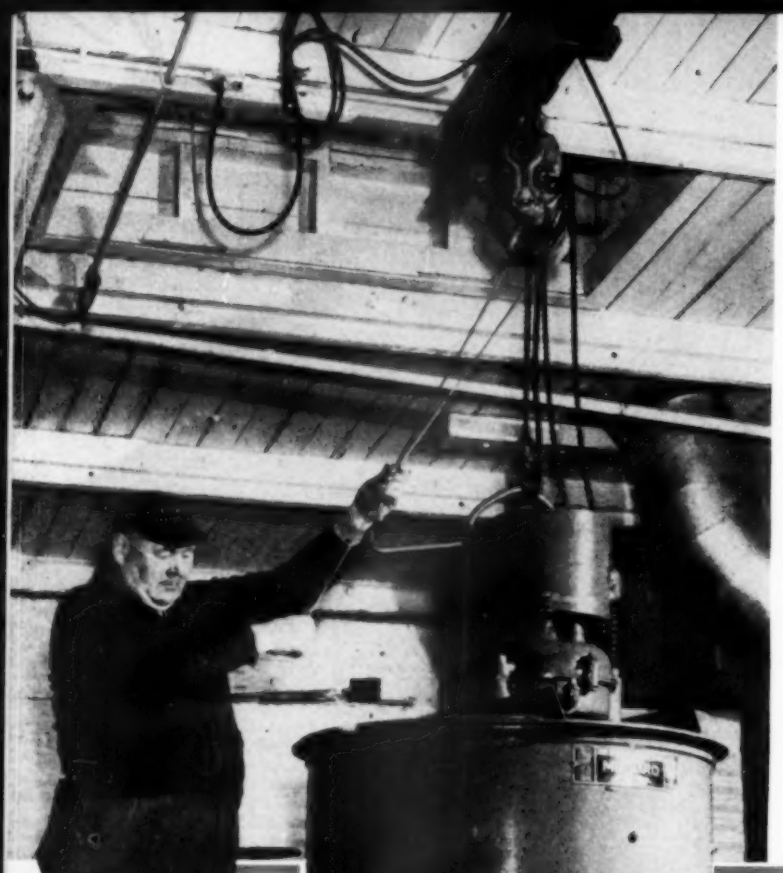
Local management then consulted the company's safety engineer and industrial hygienist, various equipment

engineers, and engineers from the Bureau of Industrial Hygiene, and the recommendation was made that complete modernization should be undertaken. After all facts and figures were assembled, an appropriation of approximately $100,000 was allotted by top management for the work.

One of the first steps was to provide an adequate wash and locker room. This gives the workman a clean place to hang his street clothes and also to dry out his damp work clothes while he is off the job. Complete washing facilities including showers are available, and employees are encouraged to use them. It is felt that the foundry workman will be respected by other types of workers as well as by his family if he meets the public in clean clothes, and certainly it is a boost to his own ego. In planning the new locker room care was taken to locate it near the foundry entrance.

Space also was made available for an airy, clean, spacious and well lighted toilet room directly off the foundry and readily accessible to all the foundry workers. With an entire male personnel only one room was necessary.

Medical facilities of the plant were carefully scrutinized to make certain that all services required by the foundry were available. The medical department includes suitable



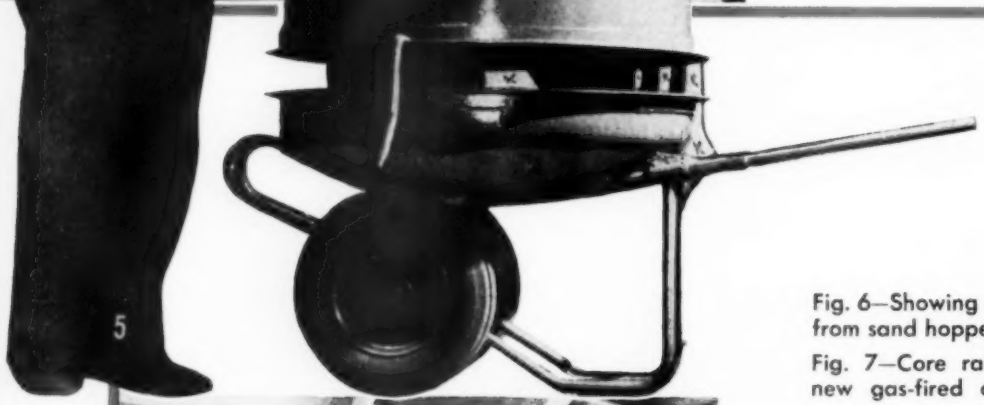
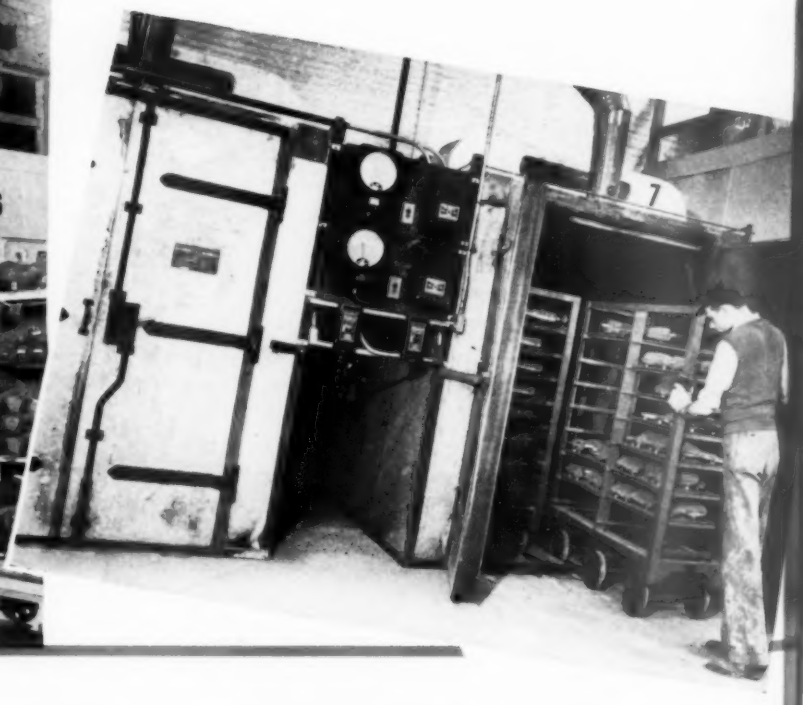


Fig. 5—Portable unit employed to mull core sand. The prepared sand is dumped directly into a hopper equipped with gravity feed chutes leading to four core molding benches on the foundry level

Fig. 6—Showing part of coremaking department with chutes from sand hopper on balcony floor to coremakers' benches

Fig. 7—Core rack truck being pushed into one of two new gas-fired ovens. Temperature is controlled automatically



waiting and consultation rooms. A physician in charge makes regular daily visits to the plant to examine new employees and consult with old employees regarding general health problems and accidental injuries. In addition, registered nurses are in attendance at all times. A panel of specialists, as well as the plant physician, are constantly on call in case of serious injury. Arrangements have been made with a local hospital to obtain both pre-employment and periodical chest x-rays of foundry workers.

The prospective worker is given a thorough interview by the employment department. Before he begins to work, he is checked by the doctor to determine if he is physically fitted for the specific job. If there is any indication that he has previously contracted silicosis, tuberculosis or other disabling factors, he is certified for suitable work in the plant, outside the foundry. In this way the new employee knows that, so far as his health is concerned, he is able to do the assigned work.

In considering modernization of the foundry process, it was agreed that every possible change should be made to introduce labor-saving devices, incorporate a maximum of mechanization, improve lighting, reduce noise and control dust. As a result the heart of the foundry now is a turntable molding unit having four working stations. Pattern and flask are assembled at the first station. Sand is rammed by a sandslinger at the second. Cope or drag is struck off at the third, and at the fourth station bottom boards are set in place on the drag half of the mold. The pattern is stripped and the half molds removed and turned over and placed in position on a roller conveyor for the core setter.

This molding process almost entirely has replaced the more laborious and time-consuming hand squeezer machine molding. At present only one station is operated in the former manner. Excess sand, as delivered by the sandslinger or struck off the molds, is delivered to the sand conditioning system through floor gratings. At the core station, the mold is cored and closed and started along the roller conveyor toward the pouring station.

Aluminum is melted in two 400-lb capacity gas-fired crucible type furnaces. A mechanically exhausted canopy hood over each furnace removes heat and fumes developed during melting, fluxing and tapping.

The ladle of molten metal is lifted by a small hoist suspended from a monrail leading to the pouring station on the roller conveyor line. A combination canopy and lateral mechanical exhaust hood controls dust, heat, smoke, and fumes at this station.

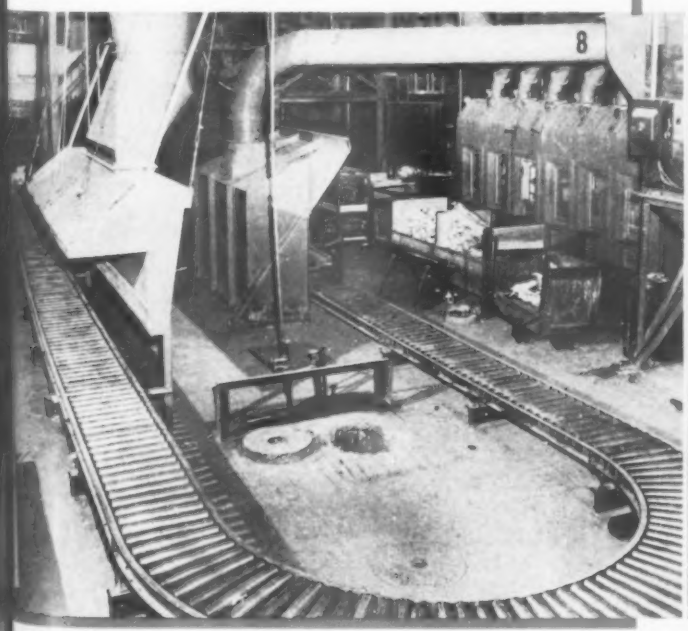
Poured molds are allowed to cool for a short time and then are pushed along the roller conveyor to a manual dump where dust is controlled by a lateral mechanical exhaust hood.

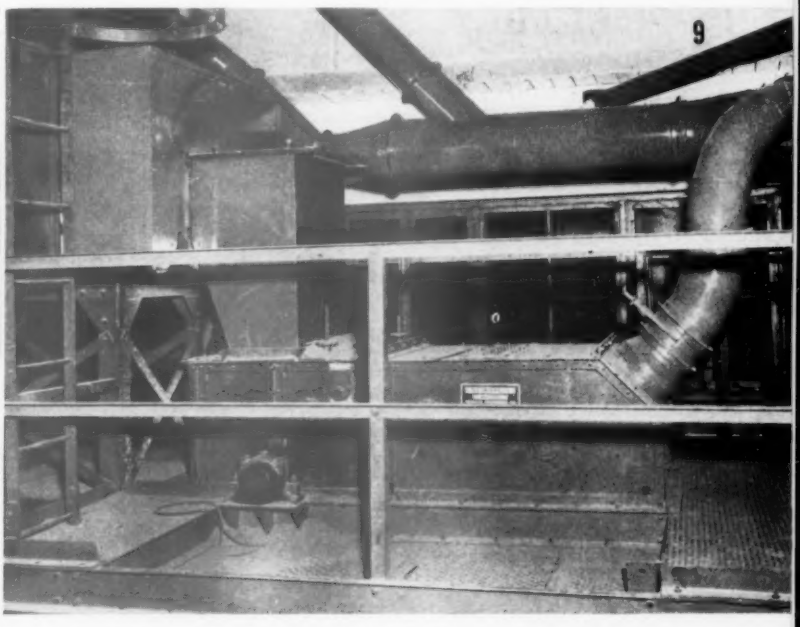
Dumped molding sand falls through an open grating onto a tempering belt within an exhausted under-floor tunnel. This conveyor also serves the turntable molding stations. The sand is transferred to an enclosed and exhausted bucket elevator which discharges at the top of the enclosed and exhausted sand conditioning unit. Sand is then screened, aerated, and passed to a 10-ton storage bin equipped with a horizontal plate feeder delivering directly to the hopper of the sandslinger.

After the molds have been dumped, bottom boards and flasks are returned by the roller conveyor to the first position at the rotary molding station. The roller conveyor referred to several times is in the form of an

Fig. 8—Roller conveyor line showing pouring station at left. Poured molds are pushed along the conveyor to the shakeout where they are dumped manually. Bottom boards and flasks are returned by the conveyor to the molding station

Fig. 9—Sand from the mechanical shakeout is transferred by conveyor belt and bucket elevator to this enclosed conditioning unit where it is screened and aerated, then delivered to a 10-ton capacity storage bin





"A Good Place To Work"

Fig. 10—Stand grinders are equipped with efficient exhaust hoods

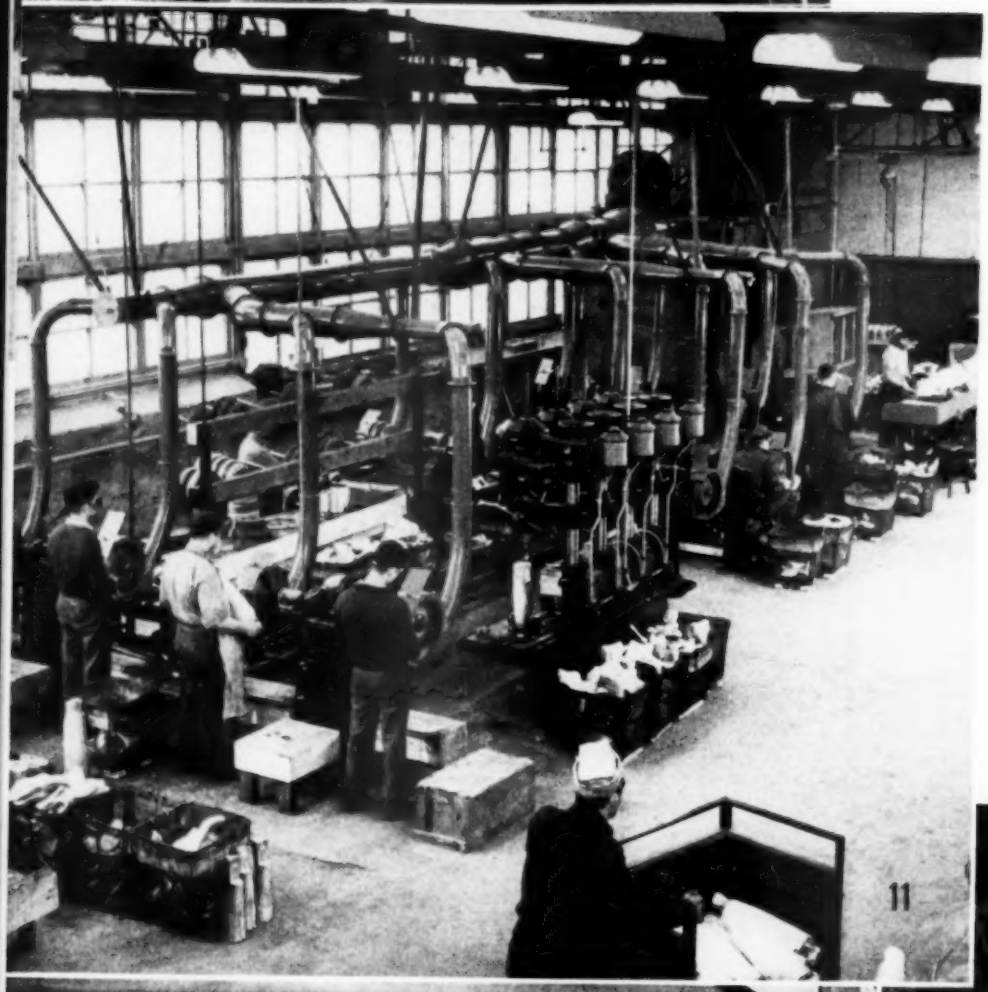


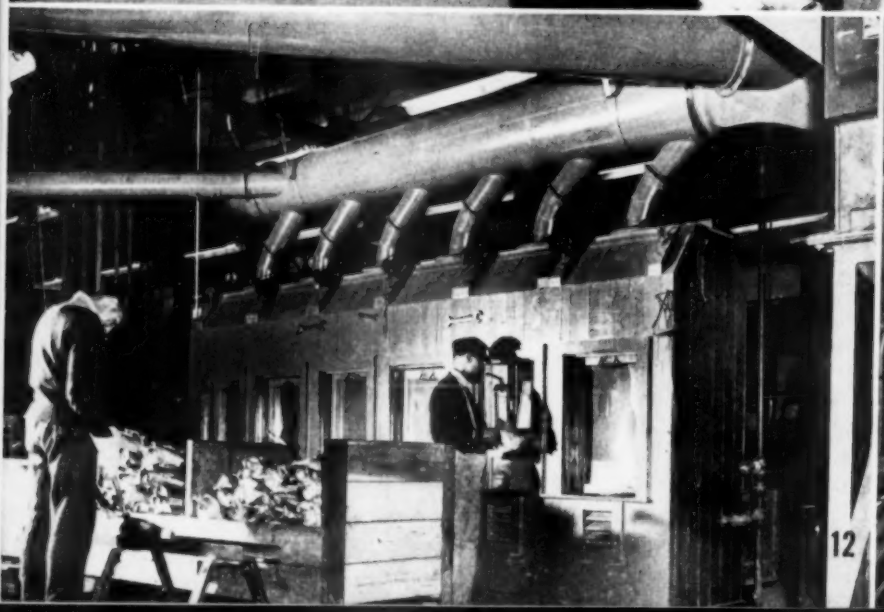
Fig. 11—General view of finishing department

Fig. 12—Rap-out cabinet is divided into six booths and lined with insulation material to reduce noise transmission

Fig. 13—Molding station where flasks are rammed by a sandslinger

Fig. 14 — Close-up view of turntable molding unit showing the four working stations

Fig, 15—Strong exhaust at the hooded shakeout controls dust created when molds are dumped



elongated horseshoe and probably is the greatest factor in the saving of laborious work. It is long enough to store molds in process and definitely limits the lifting load of any worker to the weight of a drag or cope through a distance of not more than 3 ft.

Cored castings removed at the dump are placed on a rack for cooling and then transferred to a bin for temporary storage prior to placing them in a compartmental core rap-out cabinet. This cabinet is divided into six booths which are lined with insulation material and fitted with double glass sliding doors to reduce the noise transmission. The lower section of each compartment is equipped with louvers to admit air and is fitted with a sliding drawer to collect the core sand. A duct connection at the top leading to the exhaust provides control of fine dust. Periodic collection is made of the core sand, which is taken by hand truck to the second floor core sand preparation room for riddling under an exhaust hood and reused.

In the original foundry a great deal of laborious work went into the trucking, hand cutting and mixing of the core sand. Now the sand is trucked from the street and brought directly through a door cut through the wall at the second floor level. After being mulled in a portable muller, the core sand is dumped directly into a hopper equipped with gravity feed chutes leading down to four core molding benches on the foundry level.

Baking of cores also has been simplified by rack trucks which are pushed into two new gas-fired, air-circulating, automatic temperature-controlled and vented core ovens.

Lack of suitable storage space for new molding sand presented a serious problem. A bin was built at the end of the foundry floor, near the street to take advantage of the street grade. A truck load of sand now is dumped from the street into a chute leading directly into the bin. Small quantities, as required are introduced into the sand conditioner on an average of once a week by the simple process of dumping from a wheelbarrow into the floor grating located at the sandslinger.

From the rap-out cabinet, the castings are hand trucked to the finished line where they are given a low pressure internal water wash to remove all traces of core sand. This process replaces a high-pressure air blow-out which dispersed a considerable quantity of fine dust.

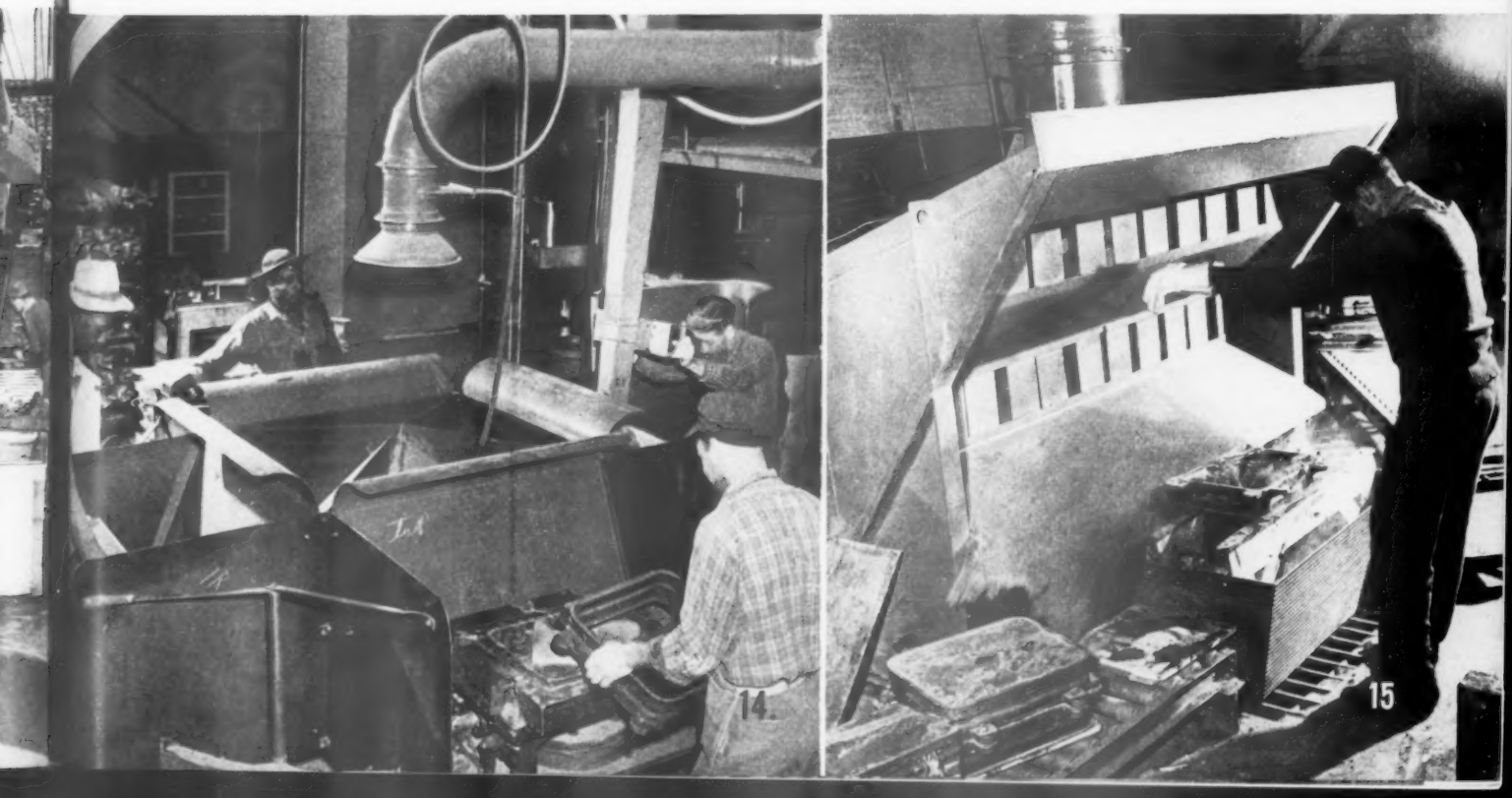
Clean castings are thoroughly inspected. Pin holes are corrected by oxyacetylene welding. Castings then are ready for grinding and polishing.

All finishing is done at hooded and exhausted grinding and polishing jacks by artificial abrasive wheels. The nature of the work requires the use of open-side wheel hoods. However, the provision of exhaust considerably in excess of that recommended by the AFA Code for Grinding, Polishing & Buffing Equipment Sanitation gives excellent dust control.

Entering this foundry for the first time a new worker or a guest unfamiliar with the processes would not immediately realize he was in a foundry. The popular mental picture, with men and equipment dimly outlined through clouds of smoke and dust, just isn't there. Here is an orderly, well lighted shop where no one is asked to work under conditions unduly dangerous to life or limb or which, by comparison with other industry in the same community, are either particularly arduous or unpleasant.

Since modernization of this foundry has been completed only recently, it is not possible to ascertain exactly what economies of operation have been gained. However, it has been definitely established that there is no longer any difficulty in obtaining new workers. In fact, in 1944 there were only 20 workers in the foundry and finishing department, and now there are over 30. Production per man has increased materially and is expected to go much higher when each worker becomes more familiar with the mechanical equipment.

While the foregoing improvements are related to one specific foundry, the principles involved are universal in application. The medical (*Please turn to page* 223)



AFA Sessions Detail

CASTING DEVELOPMENTS

FIRST in the series of four sessions sponsored during the recent AFA convention by the Steel Division was held Tuesday afternoon, Apr. 29, with C. W. Briggs, Steel Founders' Society of America, Cleveland, presiding, and L. H. Hahn, Sivyer Steel Casting Co., Chicago, as co-chairman.

This was to have been the occasion for presentation of the exchange paper of the Institute of British Foundrymen—a paper titled "Side-Blown Converter Practice" and authored by F. Sousans, Hadfields Ltd., Sheffield, England, but with the author not having arrived, nor copy of the paper having been received, the contribution was acknowledged and deferred for publication.

Concluding reports are presented here on the technical papers and discussions heard at the recent 51st annual meeting of the American Foundrymen's Association in Detroit. Reports on other sessions appeared in the June issue

From time to time in the production of cast steel, heats are produced having unusual characteristics that cannot be attributed to composition alone, and these peculiarities are then ascribed to some effect of the melting or deoxidation practice. Often the specific variable can be isolated by a thorough metallurgical study, but not infrequently the cause is only a matter of speculation.

To compare the properties of steel produced by different melting methods but under otherwise comparable conditions, and to investigate those conditions that might account for the variations in properties not entirely accounted for by chemical composition was made the object of study through work done under contract No. OEMsr-450 between Battelle Memorial Institute, Columbus, O., and the Office of Scientific Research and Development. Results were reported in a paper, "Some Effects of Melting Practice on Prop- (*Please turn to page* 122)

R. H. McCarroll (left), director, chemical engineering and chemical and metallurgical research, and F. C. Riecks, director, technical controls department of the foundry, Ford Motor Co., at a luncheon tendered by the company at Dearborn Inn, May 2, for visiting foundrymen. Views below show some of the hundreds of AFA convention visitors who participated in the "Ford Day" inspection of the Rouge plant and foundry that day

Hard Iron for Mixer Blades

Q.—We shall appreciate information on how to make hard, tough iron from concrete mixer blades. Can this iron be made from all scrap charges in the cupola?

A.—Approximate analysis for the blade castings in a concrete mixer will show: TC 3.00 to 3.20 per cent; Si 0.80 per cent; S 0.10 per cent; P 0.40 per cent and Mn 0.80 per cent. Obviously any kind of iron melted in the cupola to yield metal of the foregoing composition will serve. Equally obvious is the fact that it will be extremely difficult, if not actually impossible, to produce uniform castings from day to day from a cupola charge made up of scrap in which the composition may be as

Questions and Answers

variable and unknown as the *X* in algebra. A highly experienced foundryman can make a fairly close guess, but it is still only a guess.

All of which is just another way of saying that fairly satisfactory blade castings may be made from a miscellaneous scrap charge melted in the cupola, but they will not meet the requirements of a customer who insists on definite chemical and physical properties. Carbon and silicon are changed to some extent during the melting operation, but in a general way it may be said that the composition of the iron leaving the tap hole is the same as that of the material thrown in at the charging door. Scrap charges, or, for that matter, any kind of charges may be *doctored* by the addition of certain alloys, nickel, chromium, molybdenum, vanadium, to meet the most exacting specifications; in this particular instance, hardness and strength.

Shrinkage Causes Black Area

Q.—We are sending you a portion of a medium steel casting which has been tested to destruction. We will appreciate your advice as to the classification and cause of the condition shown by the black portion of the casting at the fractures. The casting was gated at the base of the stem and risered from the end of the same. We realize that inasmuch as the design is T-form there is considerable draw in the center, but it is not considered critical. The black section shown is not common in our castings, but as it has been found a few times, we would like to know the cause.

A.—The specimen submitted for examination exhibits characteristic shrinkage cavities located at sharp corners at the ends of the top bar of the T-shape piece. Not knowing the shape or size of the whole casting, nor the location of the head used, it is difficult to determine how the job was molded. However, the defect is typical and due primarily to improper feeding of the section where it occurs. This results in small hollow places which give rise to the tearing open of the pieces at the sharp corner, allowing access to the air.

The black color is due to oxidation of the surface of the crack by the oxygen of the air, made more pronounced by the fact that tears of that type always occur at a temperature just below the freezing point of the steel. It is more probable that careful examination of the casting would have revealed the cracks on the surface before the piece was broken apart. Remedy is proper location of the head, and possibly the use of an external chill at each corner, and larger fillets at those two points. However, it will be necessary to have a sketch showing the entire piece before any suggestions could be made on the most suitable method of gating and heading.

Desires Minimum Tin in Brass

Q.—We are melting brass containing 60 per cent Cu, 37 per cent Zn, 3 per cent Pb in electric furnaces. The tin is limited to 0.3 per cent max., but very often we have trouble with the tin being too high, and we would like to know how to remove the tin without losing any of the other elements.

A.—We regret that we are unable to make any suggestions on how you can eliminate the excess tin in the brass you are melting except by selecting raw materials which will give the desired results. Evidently, some tin-bearing scrap is entering your heats since presumably you are using some scrap in formulating your heats. It appears that the elimination of the tin-containing brasses and bronzes should not be too hard since they ordinarily are a decided red in color as opposed to the yellow brass you are producing. However, if scrap copper is used, it would not be easy to make such distinction. Of course, the only way to make sure would be to melt the scrap materials, pour into ingots which are analyzed for composition, and then make adjustments with copper ingot and zinc to insure the final desired analysis in the end product.

The only way in which tin may be removed as far as we know is by oxidation, and of course, that procedure will also result in loss of zinc. Possibly since you only want to remove small quantities of tin, it might be accomplished without too great a zinc loss through the addition of some oxidizing material to the melt just previous to pouring—and then deoxidizing the melt. For example many references are given of melting brasses and bronzes in England and on the Continent with manganese ore placed at the bottom of the charge. Presumably the practice does not cause any great loss of the low melting point metals although no direct evidence is given on that point.

Study in England during the past few years on degassing bronzes has led to recommendation of an oxidation cycle followed by one of deoxidation. In one method, using as the oxidizing flux a mixture of approximately equal parts by weight of borax, copper oxide and sand, mention is made of a slight loss in tin. About 1 oz of the flux is used per pound of metal. The flux is pre-fused, and is added with the charge. The flux is thickened easily with sand for removal when the

metal is to be poured. Usual procedure is to push the flux aside after the metal is molten, and add half the chosen deoxidant (phosphor-copper). Then superheat for 10 to 15 minutes, mix flux with metal, allow to separate, thicken with sand and remove the flux. Remaining deoxidant is added.

This oxidation-deoxidation procedure is one used for copper-tin bronzes, and may not be applicable for the brasses for the purpose of removing part of the tin, but it might be worth a trial. Possibly, you might change the procedure to adding all the deoxidizer after superheating and removing the flux.

Fine Sand for Smooth Surface

Q.—We shall appreciate your opinion on the use of 0 or 00 Albany sand for molding aluminum castings. The surface of the castings must be exceptionally clean and smooth, to cut down as much as possible on the polishing job.

A.—Double 0 Albany molding sand is accepted generally as a satisfactory sand for producing a smooth surface on light ferrous and nonferrous castings. For a superfine finish some aluminum foundrymen use a sand known as Windsor Locks. You probably can order it through your present source of sand supply. Several grades of fine sand in Ohio, Kentucky and Tennessee are available and are widely used. You might be interested in a book *Foundry Sand, Its Use and Abuse*, written by the late E. W. Smith, for many years general foundry superintendent, Crane Co., Chicago. In addition to a great deal of practical advice on foundry problems based on sand, the book, which may be ordered from the Penton Publishing Co., Cleveland, contains a list of many sand deposits in the United States, with description, data and specifications of their characteristics from a foundry viewpoint.

Molds To Make Iron Castings

Q.—We are interested in the subject of permanent molds for gray iron castings and shall appreciate any available information on materials, construction, design and operation.

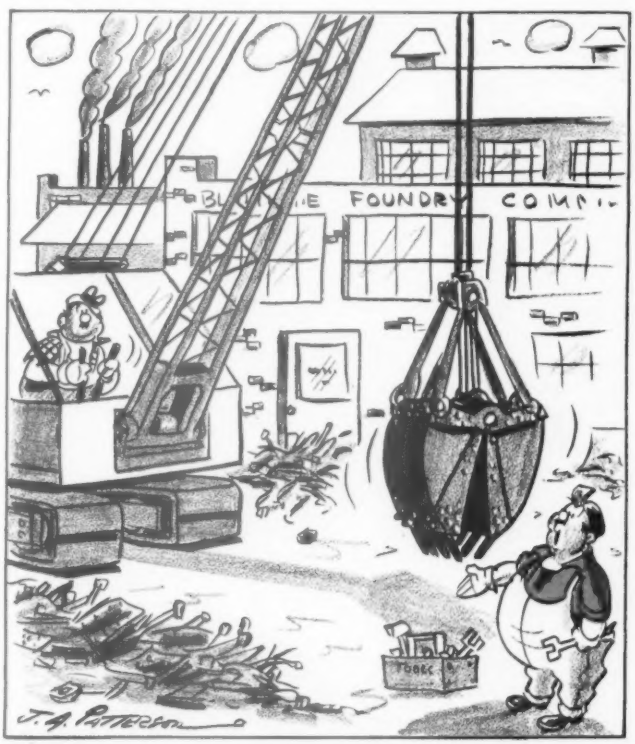
A.—During the past several years detailed descriptions of the permanent molding process as applied to the manufacture of small castings up to 20 lb in weight and in practically all metals, have appeared in various publications. The following excerpt from one of these articles may serve your present purpose. The author is referring to a revolving machine with 12 molds on the perimeter.

"The molds are made of heat resisting cast iron. They are made in four sizes and are interchangeable. Casting sizes are limited to 12 in. in length or diameter and from 15 to 18 lb in weight. Design of castings to be produced by the permanent mold process is basically the same as for other types of molding, but differs in a few respects. First, it is important to the life of the mold that the casting cavity be as uniform as possible to permit easy ejecting of the casting and to protect the mold from excessive wear. Second, the permanent mold should have a flat parting line. A small amount of taper or molding draft should be allowed from the parting line to the deeper area at the bottom of the mold cavity.

"Walls around the mold cavity must be of the proper thickness to permit rapid and uniform withdrawal of heat from the casting. Heat distribution should be uniform throughout the mold if localized hot or cold spots are to be avoided, and long mold life and sound castings are to be obtained. The usual cavity backing thickness ranges from ¾ to 1¼-in. To assist in heat dissipation, cooling pins about ⅜-in. diam. cover the back area of each half of the mold. Spacing of the pins is determined by actual experience, number and location being fixed by the need to keep the mold at even temperature. Usually the down sprue divides the mold in the center, but off-set sprues sometimes are used. At the bottom of the down sprue is the runner, in a horizontal plane, and usually extending practically across the face of the mold. A gate 0.045 to 0.0875 in. connects the runner with the mold cavity. One cavity may be placed above another in a multiple mold. The riser from the bottom cavity is the gate for the upper cavity. Risers, shrink bobs and traps may be located above the top cavities.

"The top of the mold is divided into three sections, the center section forming a pouring basin, and the sections at either side serving as pools for the risers. The top is given a 5° slant toward the center of the mold, and rims serve to retain the molten metal in each section. As the molds are not permeable, sufficient vent must be provided through core prints or in some other way when cores are used. One side of the core print always should face the open air. In exceptional casts relief cuts may be made across the face of the mold for gas relief. As these cuts tend to become filled with soot, they are used only as a last resort. When the core is well vented, and made with an open sand, no difficulty should arise. Vent plugs inserted in the mold cavity

GANGWAY! By J. A. PATTERSON



"I said you'll have to open a little wider if you want me to fix that tooth."

assist in permitting gases to escape. All the molds on the revolving machine may be different from each other. The only requirement is that all molds on the machine at one time, have the same cooling rate."

Small Malleable Shop Layout

Q.—We are manufacturers of bicycle component parts in New South Wales and at present are engaged in the installation of a foundry to make our own malleable castings. We intend installing a plant capable of carrying 6 to 10 molders, and in order to obviate the necessity of time wasted through molders having to carry their boxes for some distance before placing on the floor, have in mind installing a conveyor system to overcome this. We understand that white-heart malleable is more suitable for casting of small malleable bicycle parts than black-heart, and any information you can offer on that point will be appreciated.

A.—Since no white-heart malleable iron is made in this country or ever was produced except on a small scale even from the earliest times, we hardly are in a position to make any comparison of that material with black-heart malleable. which is being employed successfully in the applications you mention. It also might be pointed out that a number of foundries in England and on the Continent changed from white-heart to black-heart before the war.

Your idea of installing a conveyor line for the handling of molds is a good one, and the type and extent of such a system will depend on how much you want to spend. Probably an ideal system (employed in some production foundries here) would be to have a power driven conveyor line along which the molding machines are ranged. Molds move to a central pouring station close to the melting unit, and then to the shakeout. (See sketch 1).

Another scheme not quite so elaborate would employ roller conveyors as indicated in sketch 2 which extend toward the center of the foundry. Molds are poured at the ends of the conveyors, and after the metal has solidified the molds are pushed onto a car operating on a track located perpendicularly to the conveyors. The car transports the molds to the shakeout. Two roller conveyors are shown for each molder. One for the molds is pitched toward the center of the foundry so that the molds will roll easier in the desired direction with the assistance of gravity. The other is pitched toward the molding station to carry back flasks or jackets and weights.

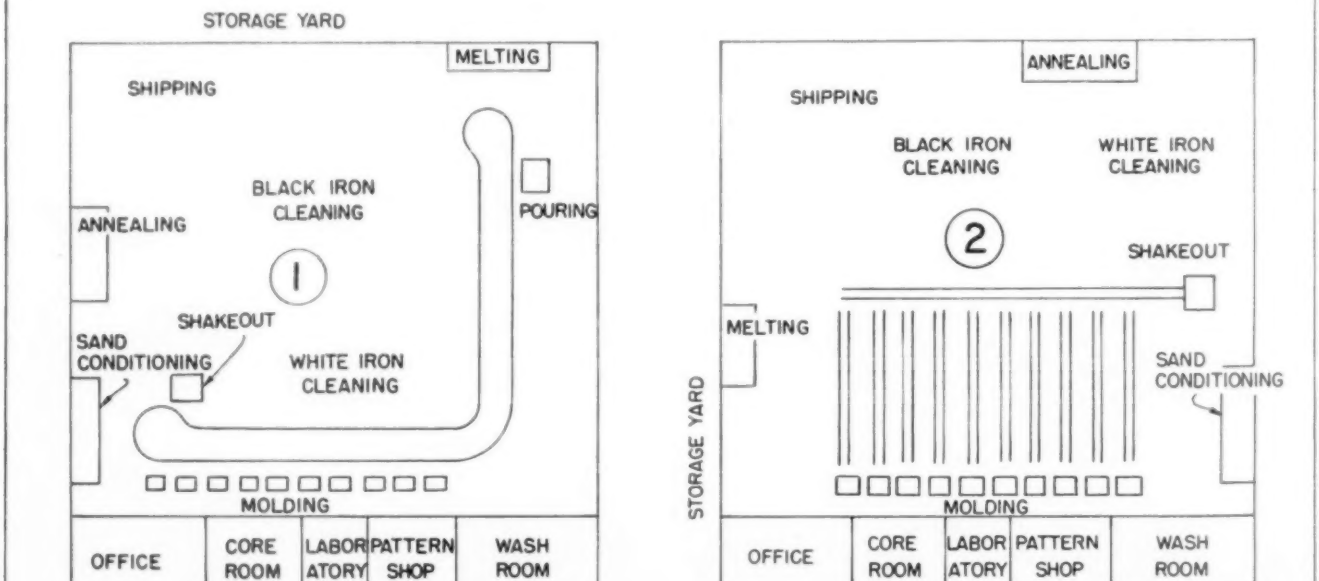
It is advisable to hood the pouring sections in both arrangements to remove smoke and fumes from the foundry proper although it is possible to place a sheet steel partition between molding section and the remainder of the foundry. Such a partition reaches to the roof and to within a few feet of the floor—allowing sufficient room to handle the molds to the conveyors.

Of course, these are just rough sketches indicating possible arrangements. The actual work should be placed in the hands of a foundry engineer who can give you the benefit if his experience in providing the most economical arrangement of equipment for the production desired.

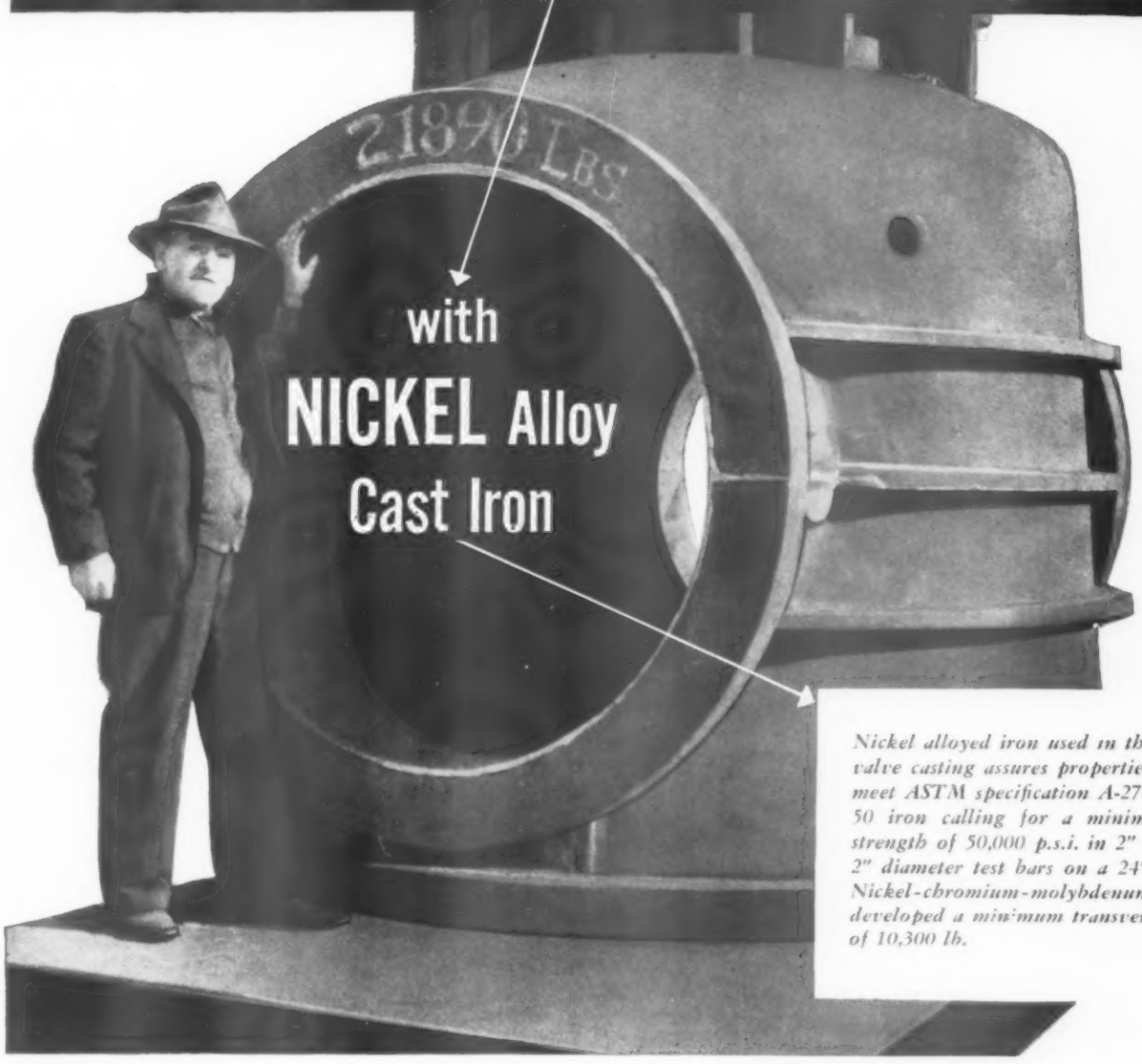
Removal of Cores from Driers

Q.—We are having difficulty in getting cores out of driers and would appreciate any suggestions you may have on how to remove them.

A.—Sticking of cores in the boxes may arise from several causes and mainly because the right proportions of oil and water are not being employed. Too much of either will cause the trouble. We have an idea that the difficulty is due to excess moisture since probably the core sand is stored where it is exposed to rain and snow. Hence, in wet weather with the sand already carrying plenty of water, the usual amount is added in mixing up the sand batches. Best results are obtained in making cores when you start with a perfectly dry sand and determine the amounts of binder and water to be added on a weight basis. In that way you will obtain a uniform product. Possibly you may also be using too much binder which is wasteful and expensive. Just use enough to provide a core which will withstand the necessary handling, etc.



Kutztown Meets Specifications for Delaware Aqueduct Job



Nickel alloyed iron used in this 54" rotovalve casting assures properties needed to meet ASTM specification A-278-44T Class 50 iron calling for a minimum tensile strength of 50,000 p.s.i. in 2" sections. In 2" diameter test bars on a 24" span, this Nickel-chromium-molybdenum cast iron developed a minimum transverse strength of 10,300 lb.

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IN THE MACHINE SHOP — Nickel cast irons provide readily machinable castings that take a smooth finish because of their improved structure and uniformity, particularly where changes in cross-section introduce difficulties and losses with unalloyed irons.

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MEN of Industry

GEORGE K. DREHER has been appointed executive director of the Foundry Educational Foundation, with headquarters at 1010 Public Square Bldg., Cleveland. Mr. Dreher attended Lawrence College, and in 1930 joined Ampco Metal Inc., Milwaukee, where he served successively as foreman, supervisor, superintendent, plant manager, and vice president in charge of manufacturing. He became vice president and general manager, Rogers Pattern & Foundry Co., Los Angeles, last year, and until recently was associated with Olds Alloys Co., Southgate, Calif. Mr. Dreher was president of the Wisconsin Chapter of the AFA from 1942 to 1944 and is now serving as a director of the national association.

♦ ♦ ♦

Theodore H. Burke, formerly in charge of foundry research and development of alloy steel castings, Otis Elevator Co., Buffalo, has been appointed foundry superintendent, New Hampshire Forge & Foundry Corp., Salmon Falls, N. H. Mr. Burke attended Pratt Institute, College of the City of New York and Columbia University. He began his foundry career in 1910, with Isaac G. Johnson & Co., New York, where he served as master steel maker and metallurgist until 1923, when he joined the Otis Elevator Co., as foundry superintendent, chemist and metallurgist. An active member of the American Foundrymen's Association, he served as first chairman of the Western New York Chapter in 1937-38.

♦ ♦ ♦

Clay Stephenson has been appointed foundry superintendent, Cooper Alloy Foundry Co., Hillsdale, N. J., manufacturers of stainless steel castings, valves, and other foundry products. Mr. Stephenson has been associated with the Unitcast Corp., Toledo, O., for the last 3½ years, in a supervisory capacity. He entered the foundry industry in 1913, as a molder with the Dayton Novel Iron Co., Dayton, O., and about 10 years later became associated with the Ohio Steel Foundry Co., in Springfield and Lima, O. He is a member of the Toledo Chapter of the AFA.

♦ ♦ ♦

K. U. Wirtz, formerly executive vice president, the Electric Furnace Co., Salem, O., has been elected president, succeeding the late R. F. Benzinger. Mr. Wirtz, a graduate of Case Institute of Technology, joined the company in 1927, as an erection engineer, subsequently serving as chief estimator, sales engineer and assistant secretary. He became executive vice president last year.

♦ ♦ ♦

Martin J. Lefler has been appointed plant manager of the South Bend, Ind., Plant No. 1, Oliver Corp., Chicago. Mr. Lefler was graduated from Michigan State College and entered the foundry industry as a laborer at Deere & Co., Moline, Ill., becoming foundry superintendent there and at its Union Malleable Iron Co. plant at East Moline, Ill. He also acted as assistant foundry superintendent, J. I. Case Threshing Machine Co., Racine, Wis., for 3 years. In 1931 he went to the Oliver Farm Equipment Co., South Bend, forerunner of Oliver Corp., where he became general foundry superintendent. He was appointed superintendent, Western Foundry Co., Chicago, in 1937 and until recently was associated with the Strom Brass Foundry, Elkhart, Ind. Mr. Lefler has been an active member of the American Foundrymen's Association and was first chairman of the Michiana Chapter.

♦ ♦ ♦

Randolph J. Roshirt has been appointed general manufacturing manager, Bohn Aluminum & Brass Corp., Detroit. Mr. Roshirt was graduated from Cornell University and became associated with the Aluminum Co. of America in 1915. He joined Bohn Aluminum and Brass Corp. in 1919 and since 1935 has been in direct charge of all foundry production. He will have charge of all manufacturing in the corporation's 14 plants, including aluminum, brass and magnesium castings, aluminum and brass forgings and extrusions, as well as brass and bronze ingot from its two smelting divisions.

♦ ♦ ♦

H. C. Wallace has been appointed manager of the Louisville district of Air Reduction, New York, succeeding the late R. S. Moore. Mr. Wallace began as an order clerk in the Louisville district in 1929 and subsequently became salesman, assistant sales manager, and in 1944 was made assistant manager. As manager of the Louisville district, at the district sales office there, he will be responsible for operations of all plants and offices in Kentucky, Tennessee and part of Indiana.

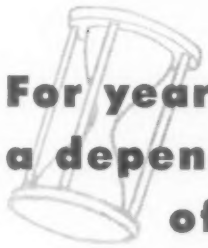
(*Continued on page* 104)

GEORGE K. DREHER

THEODORE H. BURKE

CLAY STEPHENSON

K. U. WIRTZ



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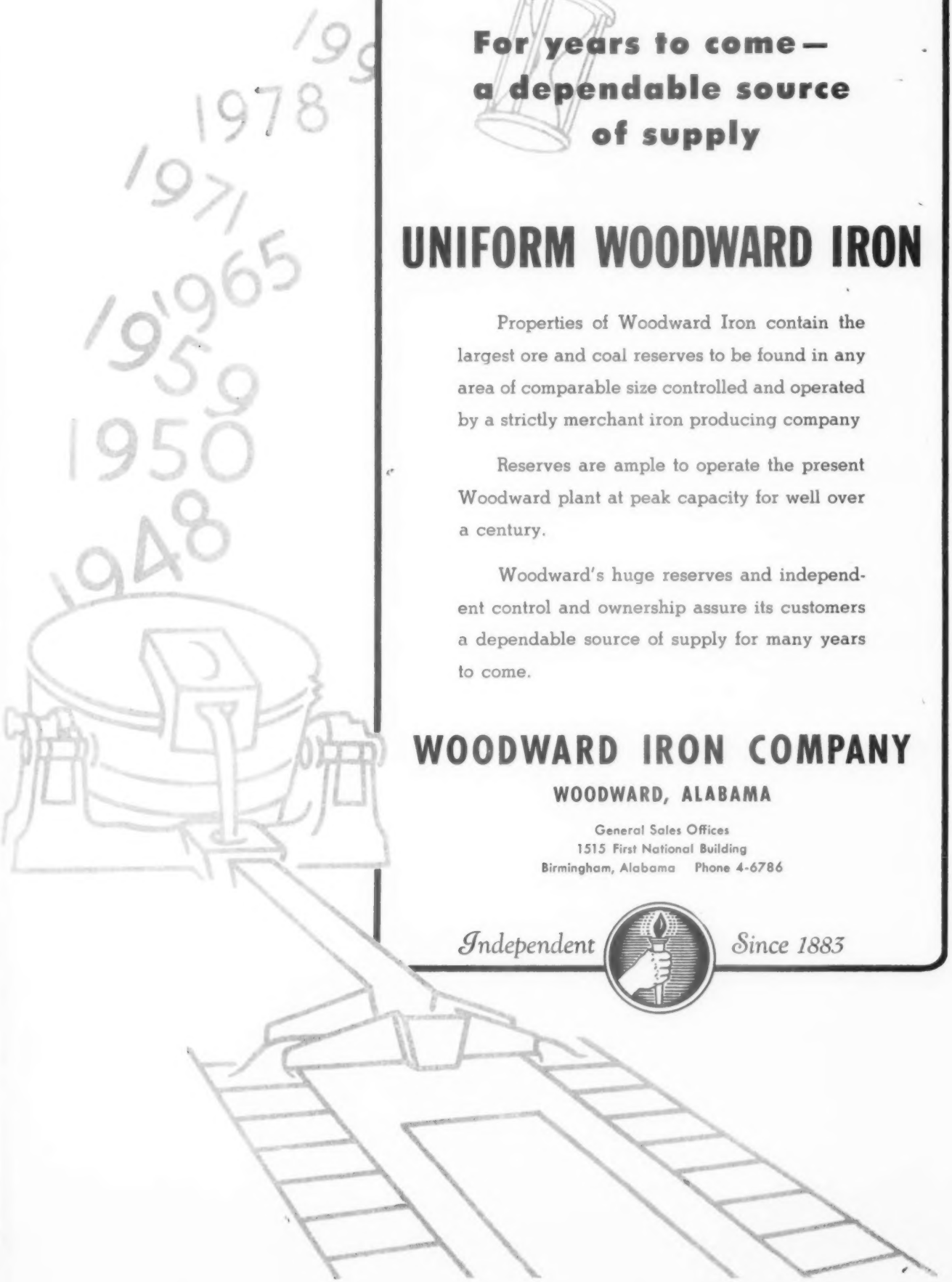


(*Continued from page* 102)

LeRoy E. Roark, executive vice president of the National Founders Association, Chicago, is the first and only registered representative of the foundry industry concerned with legislative matters at Washington. The modification of laws now in process of being formulated has been Mr. Roark's most important working interest during recent months. A former member of the War Labor Board and a national figure in industrial and public relations for many years, Mr. Roark has distinguished his performance by guidance of favorable legislative factors relating to the interest of the foundry industry.

♦ ♦ ♦

John W. Clarke, who has been elected chairman of the Northwestern Pennsylvania Chapter of the AFA for the year 1947-48, is assistant superintendent of the malleable and nonferrous foundries at the Erie works of the General Electric Co. Mr. Clarke studied metallurgy at the University of Pittsburgh, and joined General Electric Co. at Erie, in 1925, as a molder in the nonferrous foundry, under the supervision of his father, **R. R. Clarke,** who contributed many articles covering various phases of brass foundry practice and presented a number of papers before annual conventions of the AFA. In 1929 Mr. Clarke was transferred to the wage payment and planning department where he remained two years; he then returned to the nonferrous foundry as a melter and later was put in charge of melting operations. He assumed his present position as assistant superintendent of the foundry division in 1937. Mr. Clarke has been active in the Northwestern Pennsylvania Chapter since its organization in 1945, and served as its vice chairman last year.

♦ ♦ ♦

Kenneth A. De Longe, who recently was elected chairman of the Metropolitan Chapter of the AFA, is a metallurgist in the Development and Research Division of the International Nickel Co. Inc., New York. Mr. De Longe was graduated from Michigan State College in 1936 with a degree in metallurgical engineering, and spent a year with General Electric Co. on engineering test course. He entered the research laboratory of International Nickel Co. Inc., Bayonne, N. J., in 1937 to work on alloy cast iron, and 3 years later was transferred to the Development and Research Division at the New York office to continue development work in nickel cast iron and to specialize in abrasion resisting irons. Mr. De Longe has been active in the Metropolitan Chapter for a number of years, and served as vice president in 1946-47.

♦ ♦ ♦

Homer Parsons has been appointed director of exports for the American Brake Shoe Co., New York. Mr. Parsons, a graduate of Fishburne Military School, has had over 19 years of experience in the export field. He joined American Brake Shoe Co. in 1945 and has been serving as assistant director of exports for the last 6 months.

♦ ♦ ♦

Samuel Appelby, until recently works manager, Colonial Foundry Co., Louisville, O., has been appointed superintendent, Lake Erie Foundry Co. Inc., Buffalo. Mr. Appelby spent 8 years as superintendent, Buffalo Foundry & Machine Co., Buffalo, and prior to that was assistant foundry superintendent, McIntosh & Seymour Diesel Engine Division, American Locomotive Co., Auburn, N. Y., for 14 years.

♦ ♦ ♦

E. C. Hoenicke, general manager of the Foundry Division, Eaton Mfg. Co., Detroit, has been appointed a member of the Detroit Regional Steel, Foundry & Scrap Industries' Committee for expediting iron and steel scrap. The Detroit committee is one of 35 national committees appointed to co-operate with War Assets Administration in liquidating a substantial tonnage of surplus, obsolete, and worn-out equipment to relieve the critical scrap shortage.

♦ ♦ ♦

J. D. Sullivan, assistant to the director, Battelle Memorial Institute, Columbus, O., has been installed as national president, American Ceramic Society. Mr. Sullivan served as treasurer in 1944-45 and was vice president last year. **J. W. Whittemore,** Virginia Polytechnic Institute, Blacksburg, Va., has become vice president and **W. E. Cramer,** Industrial Ceramic Products Inc., Columbus, O., has been named treasurer.

♦ ♦ ♦

C. F. Moersch Jr. has been appointed sales engineer, Vucan Mold & Iron Co., Latrobe, Pa. Mr. Moersch attended Carnegie Institute of Technology where he majored in metallurgy, and during the recent war he served as a lieutenant in the Army Air Corps. He was formerly employed by Vanadium-Alloys Steel Co., Latrobe.

♦ ♦ ♦

Robert A. Miller has been appointed to the research staff of Battelle Institute, Columbus, O., where he will be associated with the division of industrial physics. Mr. Miller was graduated from Massachusetts Institute of Technology. Prior to military service he was a metallurgist with the Inland Steel Co., Chicago.

♦ ♦ ♦

W. C. DeRoller, until recently patternmaker, Symington-Gould Corp., Rochester, N. Y., has been made president, DeRoller-Wilshaw Pattern Works Inc. of that city.

♦ ♦ ♦

Kempton Dunn has been elected secretary of the American Brake Shoe Co., New York. Mr. Dunn has been associated with the company since 1932, following his graduation from Yale University. Appointed treasurer in 1942, he assumed the additional duties of assistant secretary of American Brake Shoe

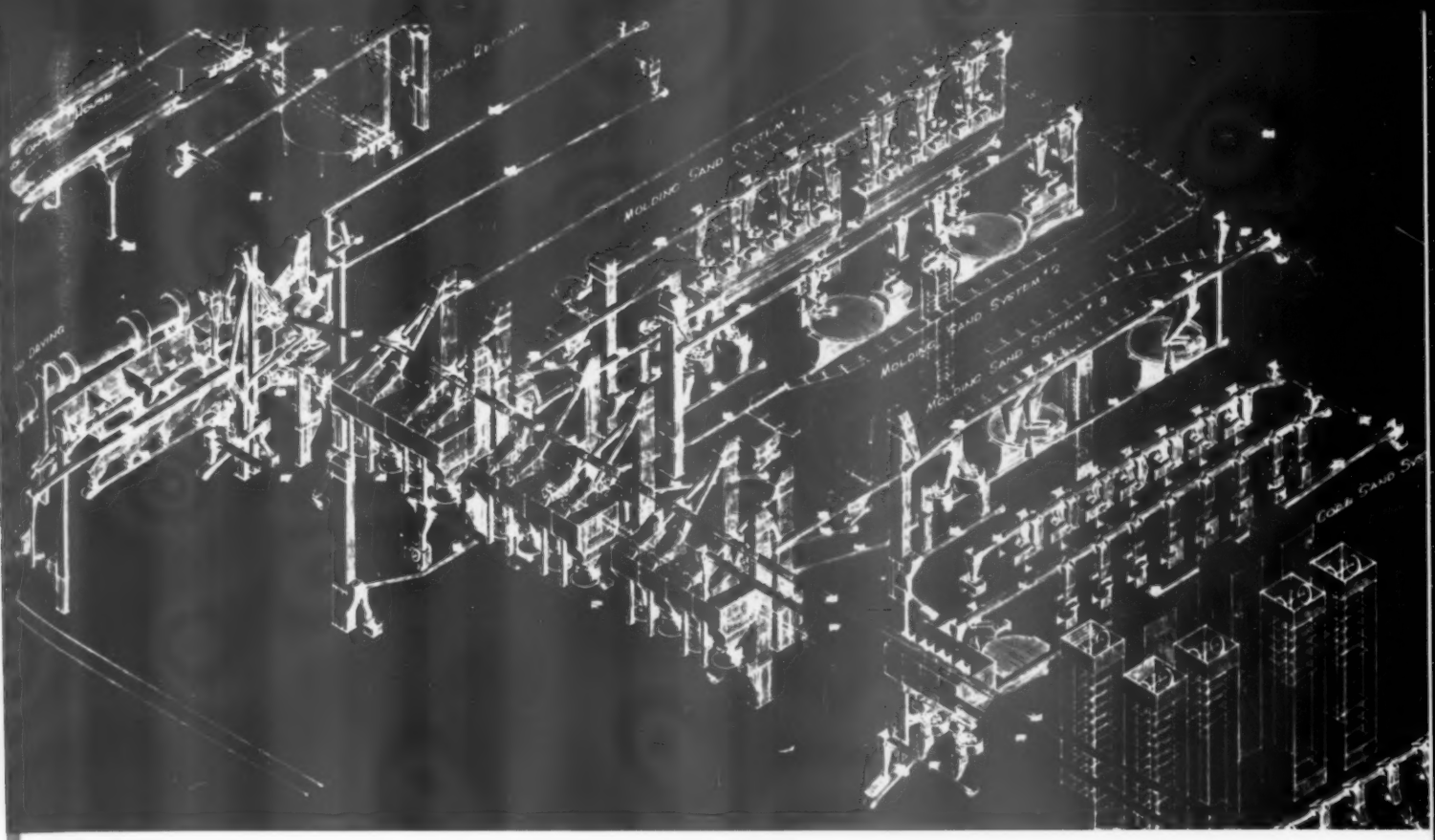
(*Continued on page* 108)

LEROY E. ROARK

JOHN W. CLARKE

KENNETH A. DELONGE

HOMER PARSONS



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. . . detailed comparison of proposals submitted showing discrepancies from specifications, over and under designs, and characteristics of maintenance, manufacturer's service and delivery.

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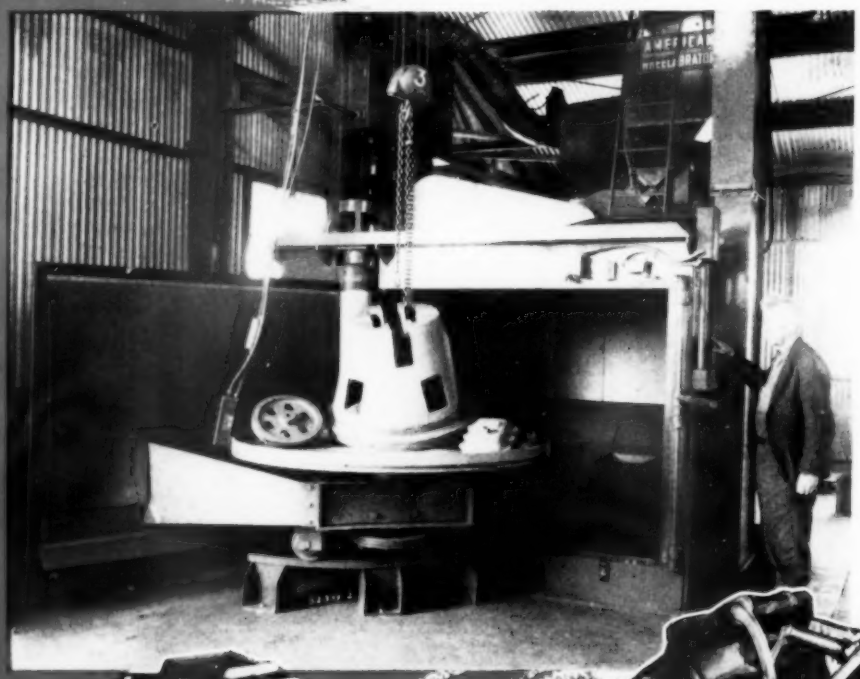

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505 S. Byrkit St. Mishawaka 2, Indiana

Swing Table Performance Speaks for Itself

A 48″ Wheelabrator Swing Table installed at the Arkansas Foundry Co., Little Rock, Arkansas cleans fan bases, pump impellers, gears, machine castings and other hard-to-clean castings. Cleaning time varies from 2½ to 4 minutes depending upon design and type of work being processed.

●

The Hamilton Brass & Aluminum Castings Co., Hamilton, Ohio cleans a wide variety of casting sizes and shapes on their 66″ Wheelabrator Swing Table. These pieces include castings for sugar refining machinery, valves, bodies, pump covers and impellers, laundry machinery parts and other types weighing from 5 to 1,350 pounds. The same quantity of work that had previously required six hours to clean in an airblast room is now cleaned in 3 hours on the Swing Table.

●

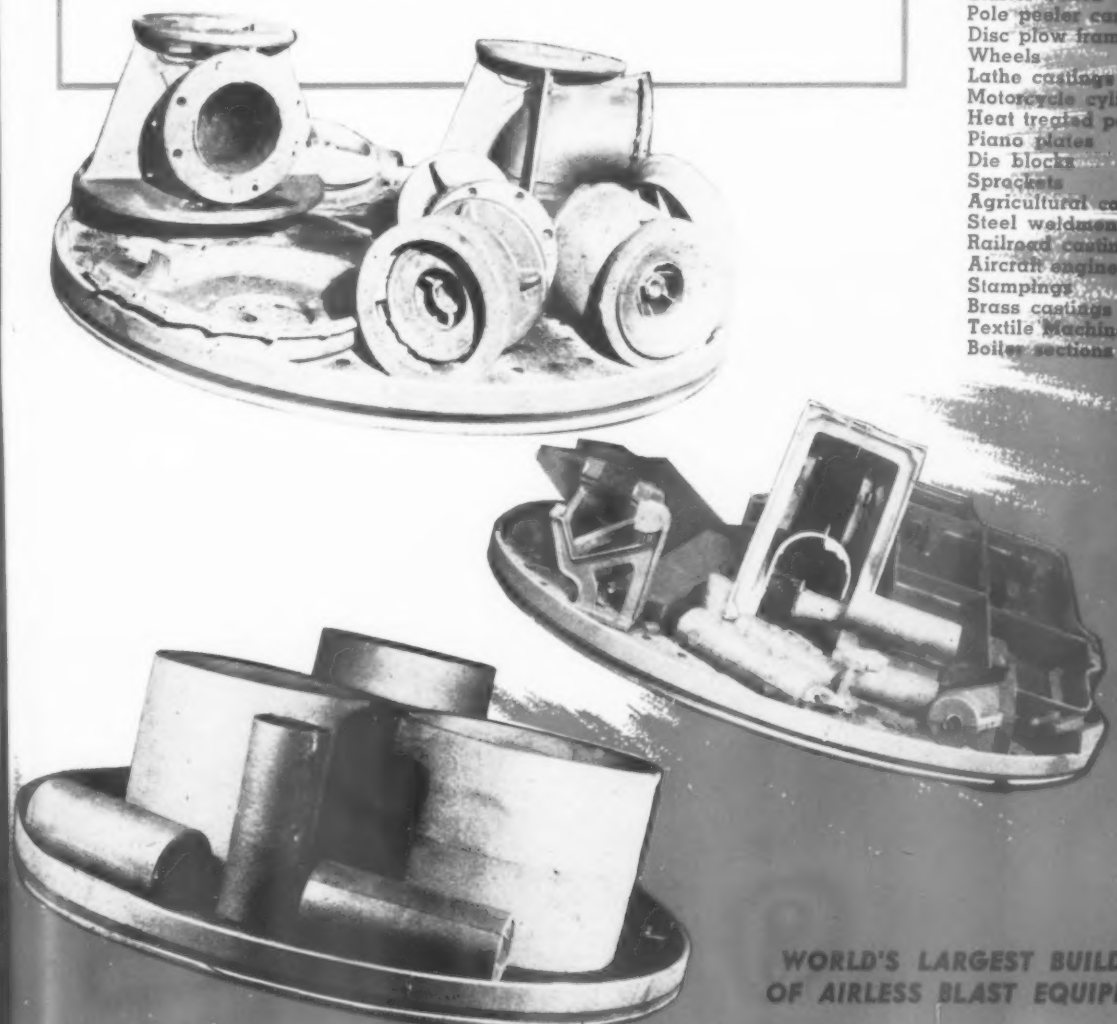
In the H. P. Deuscher Co., Hamilton, Ohio a 72″ Swing Table cleans castings weighing from 1 to 1,000 pounds in weight. This installation eliminated the tumbling mills and sand blast room formerly used to gain considerable working floor space and to improve the safety conditions in the cleaning department.

●

Six to seven tons of green stove and furnace castings are cleaned in 8 hours by the Wheelabrator Swing Table installed at the Empire Stove and Furnace Co., Ltd., Owen Sound, Ontario. From 1,200 to 1,400 pieces are cleaned in a single 8-hour period . . . a job formerly requiring nine tumbling mills and an airblast room.

Products Like These Are Being Cleaned on Wheelabrator Swing Tables

Conveyor idler-rolls
Pulleys
Bushings
Steel Castings
Stove Plate
Furnace Castings
Welded sections
Steel pipe
Electric hoist castings
Steam drum winches
Gear housings
Mine car wheels
Machine brackets
Valve bodies
Floor waxing machine parts
Cylinder blocks
Air compressors
Engine heads
Bar stock
Pump covers
Mower frames
Irrigation pump castings
Pump impellers
Motor ends
Starter boxes
Pole peeler castings
Disc plow frames
Wheels
Lathe castings
Motorcycle cylinders
Heat treated parts
Piano plates
Die blocks
Sprockets
Agricultural castings
Steel weldments
Railroad castings
Aircraft engine crankcases
Stampings
Brass castings
Textile Machinery parts
Boiler sections



WORLD'S LARGEST BUILDERS OF AIRLESS BLAST EQUIPMENT

(*Continued from page* 104)

Co. and its Canadian subsidiaries last year. With his new appointment he becomes secretary-treasurer of the company. **Sumner T. McCall,** until recently vice president and secretary, has retired. Associated with the company since 1910, Mr. McCall has held the positions of treasurer, secretary and vice president. **Cyrus E. Brush** has been elected an assistant secretary to serve with **Samuel S. Drury Jr.,** also an assistant secretary. A graduate of Cornell University, Mr. Brush has been serving the company as an attorney since his return from Navy service.

♦ ♦ ♦

Joseph G. Paule has been appointed vice president and assistant general manager, Wilson Foundry & Machine Co., Pontiac, Mich. Mr. Paule, who has served as secretary-treasurer since joining the company in 1937, was elected to the board of directors last year. **Myron Hill,** formerly comptroller, has been appointed to succeed Mr. Paule as secretary-treasurer. **B. E. Drury** has been appointed general sales manager. Mr. Drury was formerly sales manager and prior to that was assistant to the vice president in charge of sales.

♦ ♦ ♦

W. E. Jones has joined the sales staff of the Federal Foundry Supply Co., Cleveland, and will represent that company in the area centered around the tri-cities and westward through Iowa. Mr. Jones, a native of Wales, served his apprenticeship with Sandycroft Foundry & Engineering Co. there, coming to this country in 1911. He became associated with Killing Machine Foundry, Davenport, Iowa, as a molder, and later joined Bettendorf Steel Foundry, Bettendorf, Iowa, where he advanced from job molder to foundry foreman and superintendent. He served as field sales representative for Zimmerman Steel Castings Co., Bettendorf, for a few years, returning to the Bettendorf Steel Foundry in 1936. In 1942 he became general foundry superintendent of Ordnance Steel Foundry, Bettendorf, operated by Campbell, Wyant & Cannon Foundry Co., Muskegon, Mich. Mr. Jones served as chairman of the Quad-City Chapter of the AFA in 1943, and is at present a director of that chapter.

♦ ♦ ♦

Edgar H. Trick, has retired as shop superintendent of the San Antonio, Tex., plant of the Alamo Iron Works, following 32 years of continuous service. Mr. Trick spent 14 years in Pittsburgh in engineering departments of Union Foundry & Machine Co., Universal Rolling Mill Co., and Carnegie Steel Co., prior to his connection with Alamo Iron Works. He originated the Alamo core sand conditioner for mixing small batches of sand at the coremaker's bench.

♦ ♦ ♦

E. M. Weinfurtner, a former vice president of North American Refractories Co., Cleveland, has been elected president, succeeding **J. D. Ramsay,** who has been named chairman of the board of directors. **H. E. Stuhler,** vice president and treasurer, has been made first vice president and treasurer. **H. H. Hopwood** continues as a vice president and **E. W. Valensi** remains secretary and comptroller.

♦ ♦ ♦

George W. Starr, vice president in charge of sales Ohio Ferro-Alloys Corp., Canton, O., and who has had charge of sales since the company was organized in 1928, has limited his sales work to a trade territory which can be handled from his home in Poland, O. **James C. Vignos** has been put in charge of sales in the home office in Canton.

♦ ♦ ♦

A. E. Zeisel has been appointed vice president in charge of sales, Eutectic Welding Alloys Corp., New York. Mr. Zeisel became associated with the company in 1944 as a field engineer and has since been Mid-West regional manager and assistant to the president. **T. H. Leston** has been appointed chief engineer at the New York plant.

♦ ♦ ♦

Daniel J. Maykuth has been appointed to the nonferrous metallurgy division research staff, Battelle Institute, Columbus, O. Mr. Maykuth is a graduate of the Michigan College of Mining and Technology, where he served later as a member of the faculty.

♦ ♦ ♦

J. J. Nelson will represent the National Bearing Division; **T. N. Mitchell,** the Kellogg Division; **L. J. Hardwood,** the Electro-Alloys Division, and **G. E. Anne,** the Brake Shoe & Casting Division, American Brake Shoe Co., in the new Philadelphia sales office.

♦ ♦ ♦

Dr. Harold A. Vonachen, medical director of Caterpillar Tractor Co., Peoria, Ill., has been chosen president-elect of the American Association of Industrial Physicians and Surgeons for 1947-48. He was formerly first vice president.

♦ ♦ ♦

J. H. Bruhn has been appointed general foundry foreman, Eastern Malleable Iron Co., Wilmington, Del. Mr. Bruhn was formerly supervisor of molding methods for American Steel Foundries, East Chicago, Ind.

♦ ♦ ♦

Duane Vincent has been named president, United Casting Co., Clarkston, Mich., a new subsidiary of United Foundry Co., Detroit. **Walter Fry** has been appointed vice president in charge of production.

♦ ♦ ♦

C. R. Heller has been placed in charge of the sales office recently re-established in Washington, by Link-Belt Co., Chicago. Mr. Heller was chief of the material handling equipment branch of the General Industrial Equipment Division of the War Production Board, Washington, from 1942 to 1945, when he became

(*Concluded on page* 110)

JOSEPH G. PAULE

MYRON HILL

B. E. DRURY

W. E. JONES

40 to 1 with Bayflex*

30 to 1 45 to 1 25 to 1 35 to 1 50 to 1

These are typical performance reports

we suggest you do a little arithmetic

Your Question:

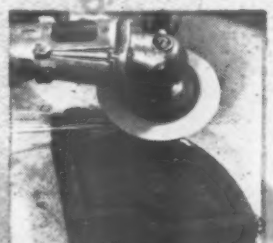
If one Bayflex disc outperforms the ordinary coated abrasive disc 40 to 1, how much will I save per year?

In your calculation you may neglect the cost of our disc wheel. Its cost is completely absorbed in the waste time saved in changing 39 ordinary discs. Yes, turned into dollars, the saving in labor cost for slacking 39 nuts, removing 39 ordinary discs, replacing 39 ordinary discs, tightening 39 nuts — gives you our disc wheel free. Please do the arithmetic. The chances are better than 40 to 1 it will pay you handsomely to buy Bayflex.

Standard sizes in a range of grits available for stock shipment. Send for descriptive literature and prices.

Branch offices & warehouses
Chicago — Detroit
Distributors — All principal cities

BUILT-IN FLEXIBILITY — PLUS FOR MAXIMUM SAFETY AND CUTTING SPEED

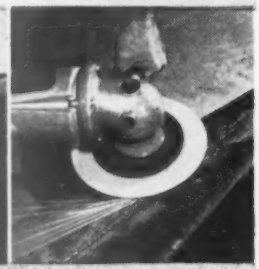


Unexcelled for cleaning castings.

For welds on angle- iron frames.

For hard-to-get-at places.

Hundreds of uses in auto repair shops



Has no equal for smoothing welds.

BAY STATE

*Reg. U. S. Pat. Off. (Resilient Abrasive Wheels Mfd. by Bay State Abrasive Products Co.)

Top Performance Consistently Duplicated

BAY STATE ABRASIVE PRODUCTS CO. • WESTBORO, MASSACHUSETTS, U.S.A.

(*Concluded from page* 108)

director of the Equipment Division of the Civilian Production Administration.

♦ ♦ ♦

Charles F. Yarham has joined the sales engineering department of the Ohio Equipment Co. Inc., Cleveland, representatives for the Yale & Towne Mfg. Co. Mr. Yarham has been associated with Euclid Road Machinery Co., Cleveland, for several years.

♦ ♦ ♦

John P. Mullen has resigned as assistant treasurer of the American Foundrymen's Association. Prior to joining the AFA a little more than a year ago Mr. Mullen was educational director of the Gray Iron Founders' Society.

♦ ♦ ♦

Justus W. Lehr has been appointed district manager in charge of the Berwick, Pa., plant of American Car & Foundry Co., New York, succeeding **Guy C. Beishline**, who resigned recently.

Dennis J. Crowley, until recently associated with the Steel Casting Division, American Radiator & Standard Sanitary Corp., Pittsburgh, has been appointed a special sales representative of Pratt & Letchworth Co. Inc., Buffalo.

♦ ♦ ♦

Clifton Brooks, formerly foundry superintendent, Busch-Sulzer Bros. Diesel Engine Co., St. Louis, has been appointed foundry superintendent, Scovel Mfg. Co., Benton Harbor, Mich.

♦ ♦ ♦

John Bromagen has been appointed foundry superintendent, the C. E. Miller Mfg. Co., Anderson, Ind., succeeding **Wilbur Barsota.**

♦ ♦ ♦

David S. Ferree has been appointed district manager of the Philadelphia sales office recently opened by the Falk Corp., Milwaukee. Mr. Ferree will cover the Pennsylvania and Delaware areas formerly handled by Martell & Ferree and the York, Pa., territory which was managed by the late John Ericson.

♦ ♦ ♦

James M. Stuart, assistant product manager of the ingot division of Reynolds Metals Co., Louisville, has been appointed product manager.

♦ ♦ ♦

Lane B. Osborn, until recently associated with Hardy Sand Co., Evansville, Ind., has been appointed sales manager, Tri-State Sand Co., Corinth, Miss.

♦ ♦ ♦

Robert Keaton has resigned as manager of the Production Foundry Co., Fort Wayne, Ind.

♦ ♦ ♦

Eugene C. Bauer Jr. has been elected a vice president, Kensington Steel Co., Chicago.

♦ ♦ ♦

John F. Wakeland, formerly superintendent, has been appointed manager, the Alabama Foundry Co., Birmingham.

SHIPMENTS OF CASTINGS

(Reported by Bureau of the Census)

Gray Iron Castings

(Net tons)

	Shipments—Total	Shipments—For Sale	Unfilled *Orders
1946			
Jan.	706,319	446,567	2,076,994
Feb.	541,177	368,384	2,152,766
Mar.	796,068	505,431	2,265,336
Apr.	856,678	529,323	2,378,348
May	757,041	454,194	2,491,811
June	735,060	435,866	2,633,118
July	810,829	475,059	2,668,782
Aug.	944,516	558,957	2,785,609
Sept.	913,824	534,310	2,881,906
Oct.	1,051,068	610,389	2,916,268
Nov.	964,300	552,696	2,888,219
Dec.	889,479	505,728	2,952,203
1947			
Jan.	1,056,050	624,511	2,985,699
Feb.	993,605	575,048	2,948,813
Mar.	1,079,140	630,028	2,963,319

* For sale only.

Malleable Iron Castings

(Net tons)

	Shipments—Total	Shipments—For Sale	Unfilled *Orders
1946			
Jan.	54,016	38,181	245,878
Feb.	40,155	29,326	248,644
Mar.	50,235	33,978	263,227
Apr.	65,010	36,298	267,713
May	62,598	34,975	271,925
June	61,650	35,468	275,845
July	64,446	38,021	271,981
Aug.	67,903	41,345	272,440
Sept.	69,507	39,631	277,309
Oct.	79,207	46,477	280,972
Nov.	68,987	39,328	278,446
Dec.	68,314	39,327	267,661
1947			
Jan.	75,898	42,414	259,764
Feb.	74,716	41,684	274,018
Mar.	76,614	43,488	280,724

* For sale only.

Steel Castings

(Net tons)

	Shipments—Total	Shipments—For Sale	Unfilled *Orders
1946			
Jan.	102,506	77,329	359,527
Feb.	60,604	45,687	387,222
Mar.	104,483	80,851	406,401
Apr.	146,608	107,313	384,653
May	130,844	94,761	374,168
June	121,522	89,533	354,367
July	117,528	82,975	356,799
Aug.	129,666	94,063	373,745
Sept.	126,471	90,567	380,589
Oct.	137,304	98,265	384,082
Nov.	130,606	93,878	372,058
Dec.	123,907	88,136	362,787
1947			
Jan.	139,029	101,140	365,476
Feb.	125,612	92,822	421,405
Mar.	134,909	99,701	434,865

* For sale only.

Aluminum Castings

(Thousands of pounds)

	Shipments—Total	Shipments—Sand	Shipments—Perm. Mold	Unfilled *Orders
1946				
Jan.	23,568	9,556	10,131	83,541
Feb.	23,231	11,613	7,866	94,858
Mar.	26,661	10,792	11,305	97,013
Apr.	27,692	11,562	11,010	100,267
May	29,179	11,827	12,220	117,710
June	28,496	11,674	11,767	118,747
July	28,828	10,706	12,213	124,457
Aug.	33,845	12,721	14,309	133,510
Sept.	32,003	12,445	13,045	136,237
Oct.	39,917	14,559	17,311	144,276
Nov.	35,635	13,192	15,440	138,270
Dec.	34,754	12,827	14,586	137,198
1947				
Jan.	39,438	14,030	16,902	131,368
Feb.	35,904	12,936	15,148	128,999

* For sale only.

Copper-base Alloy Castings

(Thousands of pounds)

	Shipments—Total	Shipments—Sand	Shipments—Perm. Mold	Unfilled *Orders
1946				
Jan.	72,265	65,107	1,886	71,827
Feb.	60,856	56,992	1,713	72,736
Mar.	74,971	66,076	2,353	70,622
Apr.	77,919	71,105	2,390	71,108
May	76,054	70,748	2,453	76,792
June	70,910	66,378	1,755	78,449
July	66,695	62,369	2,339	78,018
Aug.	77,733	72,158	2,376	77,538
Sept.	76,835	71,545	2,415	84,183
Oct.	89,148	83,610	2,559	80,770
Nov.	77,605	72,671	2,159	79,126
Dec.	77,961	73,278	2,122	80,445
1947†				
Jan.	85,783	80,524	2,164	78,874
Feb.	78,729	73,863	2,046	76,016

* For sale only.

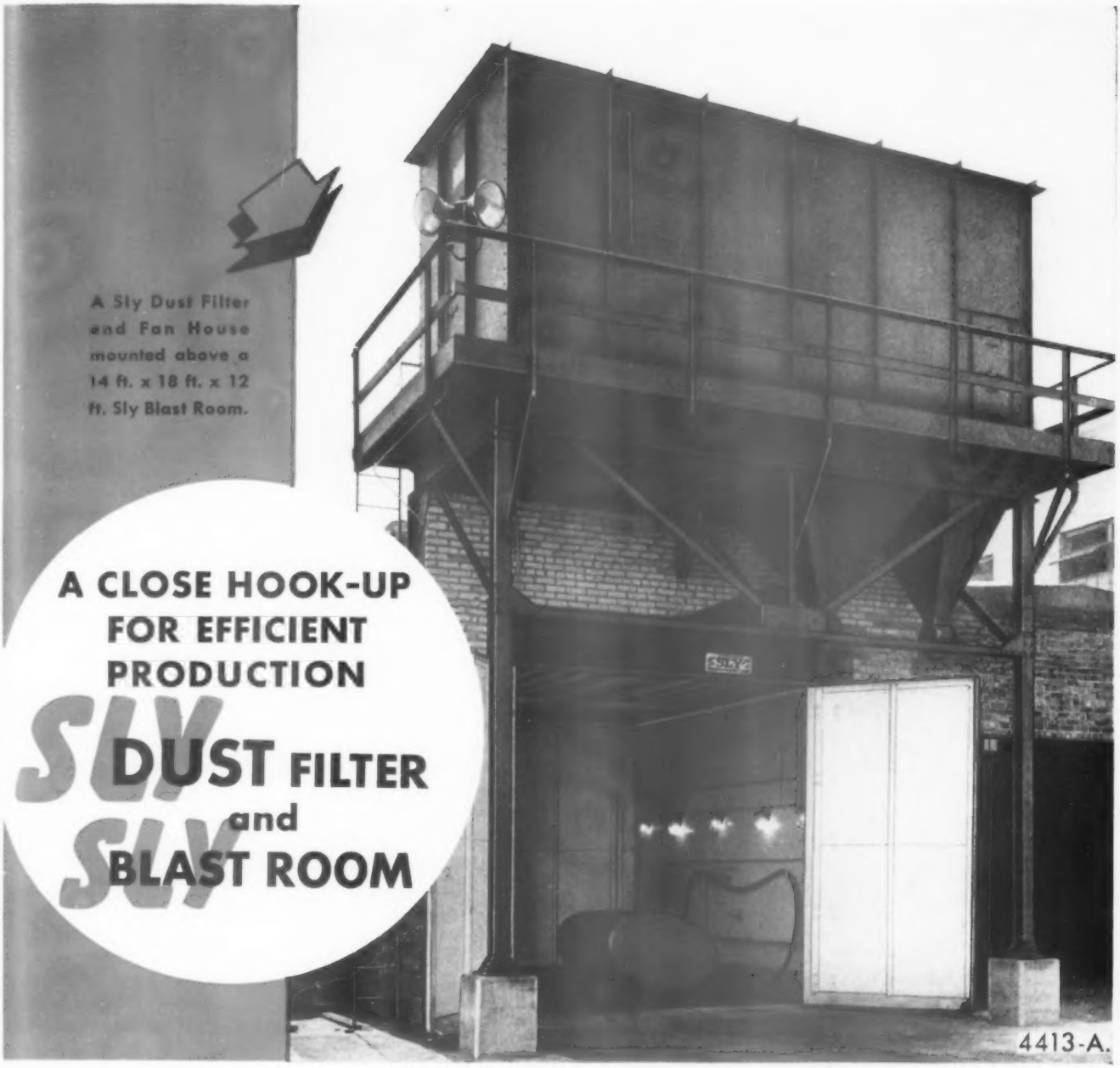
† 1947 figures include copper and copper-base alloy castings.

Magnesium Castings

(Thousands of pounds)

	Shipments—Total	Shipments—Sand	Shipments—Perm. Mold	Unfilled *Orders
1946				
Jan.	398	349	16	3,114
Feb.	438	366	35	3,338
Mar.	594	525	33	3,484
Apr.	570	465	36	3,297
May	661	587	45	3,778
June	717	623	46	4,063
July	628	477	53	3,986
Aug.	694	568	56	4,234
Sept.	811	676	61	4,096
Oct.	921	733	73	4,219
Nov.	716	574	41	4,294
Dec.	717	635	28	4,599
1947				
Jan.	809	723	40	4,480
Feb.	707	605	69	3,776

* For sale only.



A Sly Dust Filter and Fan House mounted above a 14 ft. x 18 ft. x 12 ft. Sly Blast Room.

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SLY DUST FILTER and SLY BLAST ROOM

THIS is a unique and effective combination of a Sly Dust Filter and a Sly Blast Room.

The dust filter with fan house is 18 feet long, mounted on a suitable support. Walkway and railing are standard Sly equipment.

The filter is mounted over the entrance, preventing rain from entering the room. This unit cleans the air, removing the dust generated in blast room operations by filtration through cloth. This gets all of the dust.

The blast room has "down-draft" ventilation through a special ceiling and vent ducts in the side walls. The sturdy, dust-tight light fixtures are mounted fairly low for best illumination. The room is lined with 3/16" wear plates. It is a long-lived room, providing excellent working conditions.

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SLY INDUSTRIAL DUST CONTROL

TUMBLING MILLS • BLAST CLEANING EQUIPMENT

Technical and Operating Problems

Discussed by Steel Founders' Society

By EDWIN BREMER
Metallurgical Editor
THE FOUNDRY

SECOND annual Technical and Operating Conference of the Steel Founders' Society of America, held at Hotel Statler, Cleveland, June 5, 6 and 7, set a new record in attendance and scope of subjects discussed. J. F. Lacey, Commercial Steel Casting Co., Marion, O., was chairman of the conference. More than 300 members were registered for the three-day meeting at which such phases as sands, core blowing, cleaning room problems, and heading and gating of steel castings were considered.

Conference was opened by Mr. Lacey and those in attendance were welcomed by E. D. Flintermann, Michigan Steel Casting Co., Detroit, and president of the Steel Founders' Society. First session, devoted to the subject of sand, was under the direction of I. M. Emery, Massillon Steel Casting Co., Massillon, O., and W. J. Temple, Kincaid-Osburn Electric Steel Co., San Antonio, Tex. J. B. Caine, Sawbrook Steel Castings Co., Lockland, O., described a study of the behavior of molding sand in contact with liquid steel. This paper is presented in full starting on page 72 of this issue. Mr. Caine's method of test was to immerse sand specimens in molten steel and to observe the effects obtained.

Define Reclaimed Sand

In the discussion a question was asked on the definition of reclaimed sand, and the consensus was that the term means sand which has been so treated as to remove most of the fines, etc., so that its properties approach those of new sand. It was pointed out that used sand in which only a small part of the fines have been removed, and hence differing considerably from reclaimed sand, is limited in application. Mr. Caine stated in response to a question that the glaze formed on immersion of the sand in liquid steel contained at the maximum about 2 per cent iron oxide, and the sand remained white. However, in practice the material formed at the interface of casting and sand was black in color and contained as much as 18 per cent iron oxide. He said he believed that the increase in iron oxide occurred after the metal solidified.

Second paper at the session was presented by T. W. Curry, Lynchburg Foundry Co., Lynchburg, Va., and related to the application of synthetic resin-bonded sand. The speaker pointed out that use of the sand to date has been in production of gray iron castings and that it possesses numerous advantages. With the synthetic bond the sand is tough with a high flowability; moisture content is low and less mulling is required than for other types of sands; mold hardness is greater for the same amount of ramming; cleaning costs are reduced, etc. Mr. Curry showed numerous illustrations of the types of castings produced with the synthetic bond, details on which were presented in the May issue of THE FOUNDRY.

At an industry luncheon Thursday noon J. F. Lacey, toastmaster, called on Tullie Taylor, Columbus, O., to introduce the Steel Founders' quartet composed of Messrs. Sawtelle, Emery, Heimberger and Lacey with Kermit Donaldson at the piano. The group sang several songs, including presentation for the first time of "Steel Founders' Blues," which made a hit with the crowd. Clyde R. Powell, Endicott-Johnson Shoe Co., Endicott, N. Y. was the principal speaker at the luncheon, his topic being "Controlling and Influencing Human Behavior in Accident Prevention Work." He stated that the most important factor in accident prevention is the "material between the ears," and often it is used the least. Human behavior reacts to the power of suggestion, and advantage should be taken of that fact to promote safety by setting good examples from top management down. One thing that should be remembered is to explain in detail why each safety rule is established. Often excellent co-operation is gained by consulting the employee on the proper protective device on a piece of equipment.

Thursday afternoon session was devoted to a discussion of core blowing, with A. A. Diebold, Atlas Steel Casting Co., Buffalo, and S. E. Mueller, Falk Corp., Milwaukee, presiding. Principles, methods advantages and limitations of core blowing were discussed by J. A. Mescher, Unitcast Corp., Toledo, O. Among the advantages he cited high production, uniformly high quality product, elimination of pasting, production of complicated shapes, low cost, speed in acquiring operating skill, and elimination of venting in many cases. Mr. Mescher said that he believes it is better to over-vent the corebox than to under-vent. In the case of slotted vents the ratio of vent to blowholes generally is 6 to 1 while in the case of screen vents it is 2 to 1.

The second speaker, F. Hufnagel, St. Louis Steel Casting Co., St. Louis, spoke on operational problems in core blowing in a jobbing foundry with comparatively short runs. In his shop cores up to 22 lb are blown at 95 psi air pressure. An auxiliary air tank near the blowing machine aids considerably in obtaining uniform operation. He said he found that location of large sand entrance holes over deep pockets gives good results. To determine the relation of vents and sand entrance holes to a given box, he said to first ascertain the cubic volume of the box by filling it with water. Past experience with successful operation indicated that the ratio of volume (cu in.) to area (sq in.) of the vent was 16 to 1. From the vent area the sand entrance hole area is determined and made slightly larger than that value.

Discuss Core Blowing Machines

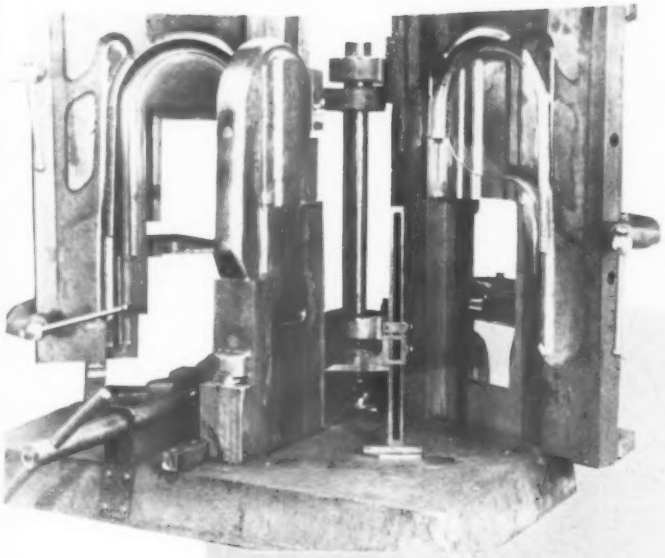
L. R. Jones, Massillon Steel Casting Co., Massillon, O., described the use of the small bench-type blower and J. J. Popa, American Steel Foundries, Alliance, O., discussed some of the difficulties encountered in placing a machine in use to blow cores on which there was no previous experience. In his opinion, each job should stand on its own feet, and in some cases considerable experimental work is required to find the proper sizes and locations of vents and blowholes to produce satisfactory cores.

C. M. Apgar, Taylor-Wharton Iron & Steel Co., High Bridge, N. J., and F. F. Dore, American Steel Foundries, Verona, Pa., presided at the Friday morning session on cleaning room problems. J. R. Flanigan, Ohio Steel Foundry Co., Springfield, O., described briefly with numerous illustrations the procedure employed by his firm in routing carbon and alloy steel castings of small and medium size through the cleaning room. Dr. O. E. Harder, Battelle Memorial Institute, Columbus, O., discussed quality and size of shot and grit employed in cleaning castings. He stated that increased production could be obtained by using larger shot or by increasing the speed of impact, but in both cases the break up of shot is high. Generally, a compromise must be employed using the largest size of shot or grit which will give reasonably rapid cleaning with a reasonable life. Dr.

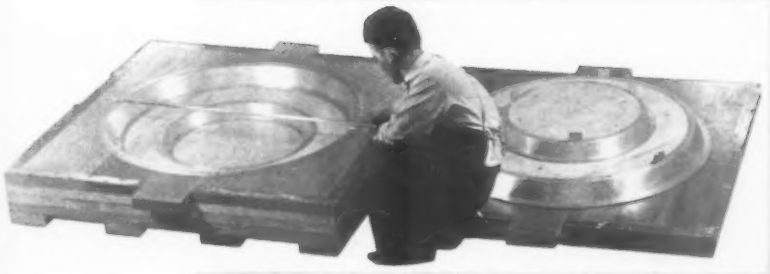
(*Concluded on page* 160)

We specialize in

PERMANENT MOLDS FOR ALUMINUM CASTINGS



This method of making aluminum castings is rapidly becoming more popular because it is based on three sound economic reasons. Aluminum castings produced in permanent molds are cleaner and better looking; they average less production cost; they can be produced much faster.



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DESIGNERS AND MANUFACTURERS OF PERMANENT MOLDS, WOOD AND METAL PATTERNS AND MODELS

Around DETROIT

By A. H. ALLEN
Detroit Editor
THE FOUNDRY

Kaiser-Frazer provided source for small gray iron castings through Round Oak acquisition . . . Ford's foundry expansion and modernization program more than 50 per cent complete

PURCHASE of the complete facilities of the Round Oak Co., Dowagiac, Mich., by Kaiser-Frazer Corp., for $262,000 cash and other considerations, will provide this automobile producer with a source for small gray iron castings required for expanded engine production, although it does not appear immediately to solve the problem of larger castings such as cylinder blocks, heads, flywheels, transmission housings and the like.

Round Oak has been a famous name in the stove field since 1871 when the company was organized to produce square-base coal and wood stoves. Later it expanded to make ranges, furnaces, stokers, air conditioning units and oil burners, and during the war supplied magnesium castings for B-29 bomber wheels. Magnesium business now has been terminated, and two cupolas are operated in production of gray iron. In addition to other business the company had been a supplier of engine manifolds for Kaiser-Frazer on a small scale, and since becoming on June 16 the K-F Dowagiac Foundry Division will devote entire output to automotive work. Current production is 50-60 tons of finished castings daily; capacity is twice that. The purchase includes the foundry, stove manufacturing plant, all inventories, patents, tradenames and other property.

K-F car production now is up to something over 450 daily and sights are being set at 1200 daily, indicating the extent of the need for additional gray iron foundry capacity. Engine castings at present are supplied by Wilson Foundry in Pontiac and Lakey Foundry & Machine Co. in Muskegon. Expansion of shipments from these sources is problematical, since Wilson, being a subsidiary of Willys-Overland, is faced with steadily accelerating demand for engine castings from the Toledo company which is bringing out an entirely new series of truck models to supplement the jeep and jeep station wagon lines.

For months, Kaiser-Frazer engineers and field men have been combing the country looking for new foundry sources. It is understood an offer was made to buy the Ferro Machine & Foundry Co. business in Cleveland, with no success. Foundry equipment sources have received numerous inquiries from K-F for machines which the company wanted to spot in plants of various present castings suppliers to augment their capacity. Inquiries were accompanied by insistent demands for almost immediate deliveries, obviously an impossibility in view of the backlog of orders which most equipment builders have from old established customers and which they are not inclined to short circuit as a favor to Kaiser-Frazer.

The Dowagiac purchase by no means solves the foundry problems of the Willow Run producer, talking in terms of 1000 or more units daily. A large expansion of the facility and a considerable addition to the present working force of 350 would have to be engineered before Messrs. Kaiser and Frazer could be relieved of their casting worries. Incidentally, the Round Oak stove manufacturing plant and business will either be sold or leased.

° ° °

SUMMARY of the postwar progress realized to date on a $12 million expansion and modernization program in the Ford production foundry was made to foundrymen visiting the Ford Motor Co. at the time of the recent AFA convention, by Frank Riecks, director of technical control department, motor and foundry group. On the cylinder block lines alone the following improvements have been completed: New coreroom, rebuilding molding lines; new automatic shotblast system, crackoff and knockout systems, chipping lines and scrap handling equipment; rearrangement of hot metal handling systems and rebuilding of the old coreroom.

In the past two years about 50 per cent of the overall program has been completed. Still to come are such projects as the revamping of an obsolete small parts cleaning department, the development of means for handling bulk materials by suction system, and equipment for reclaiming 1500 tons of foundry sand daily. Extent of the bulk material handling problem is indicated by the fact approximately 6,000,000 pounds of bagged materials are transported each month from car to job by small trucks. A suction system would permit tremendous savings in time and manpower. Many problems stand in the way of perfecting suitable pipelines and exhausters for this work, but prospects are good for its eventual realization.

Ford foundry engineers consider sand reclamation systems a must for the future. About 85 per cent of all sand used is core sand and is used only once; hence its reclamation would bring about another important saving. Mr. Riecks declared that the one problem remaining in sand reclamation is that of scrubbing sand grains to free them from impurities such as clay, and the type of equipment needed to do this depends entirely on whether a wet or dry system is used.

Use Hydraulic Trimming Presses

One interesting recent development at the Ford foundry has been the changeover from grinding to trimming of castings by hydraulic presses fitted with shear dies. Three particular parts have been changed to the new method resulting in a reduction in manpower from 18 men to one man in one case, from 28 to 3 men in another, and from 18 to 8 men in a third. An additional advantage is realized in the elimination of grinders and dust collectors formerly required, plus the fact a considerable amount of metal can be salvaged for remelting, which would otherwise be lost in the dust collector system.

Mr. Riecks commented briefly on general foundry equipment problems, citing as his belief that equipment manufacturers generally are trying to improve their products, although designers could be helped by buyers not being too anxious to buy on price. In addition, however, equipment builders should realize their laboratories are in operation daily in many foundries, and they should make a greater effort to discover in detail the problems of operators. He urged foundry management, equipment suppliers and labor to pull together to "make the job click," regardless of whether they may be considering overall planning, a casting cleaning problem or possibly an entirely new foundry development.

For those not familiar with the so-called triplex method of melting iron for Ford cylinder blocks, it may be of interest to review it briefly. Peak production, by the way, will involve casting 6000 of the V-8 blocks in two shifts, requiring pouring of 2,000,000 pounds of metal, not to mention the consumption of 2,300,000 pounds of green sand for

(*Concluded on page* 116)

Foundry Improvements

usually require that the services of owners' engineers be augmented by outside engineering facilities. CADILLAC found this desirable when making recent major improvements in their foundry.

CADILLAC Motor Car Division of General Motors has made one of the most important contributions to our automotive advance. Its confidence in the future of the Industry is evidenced by the great new foundry that CADILLAC has just completed.

The Conover Engineering Company is proud to have had the privilege of providing its Engineering Services to CADILLAC in connection with this and other expansions.

You are invited to contact Conover when planning to build a new foundry, or rebuild an old foundry. Let us advise on methods of decreasing costs and of increasing production.

CONOVER ENGINEERING CO.

O. D. CONOVER, *Consulting Engineer*

1740 East 12th St. Cleveland 14, Ohio MAin 8772

Branch Office

Industrial Bank Bldg. Detroit 26, Michigan CAdillac 8367

(*Concluded from page* 114)

molds and 1,500,000 pounds of sand for cores. Cupola metal and blast furnace hot metal are mixed in 400-ton hot metal cars and the mixture conveyed to electric furnaces which raise the temperature 300 degrees, after which the iron is poured into coal-fired air furnaces arranged for continuous pouring into two ladle cars at the cylinder block lines.

* * *

LIKELIHOOD of both Pontiac and Buick offering the Hydra-Matic type of automatic transmission on next year's models has led to ordering foundry equipment in these two plants to produce housings and other cast elements of the transmission. Delivery schedules for the equipment are reported to be based on plans to cast the first production parts in December of this year.

The transmission unit for Pontiac probably will be built by the General Motors Transmission Division which operates a large plant in Detroit now for building the units for Oldsmobile and Cadillac. Expansion of this division to handle the additional load will be necessary, and two possible locations for a new plant have been considered; one the unfinished Chevrolet light car plant in Cleveland (this project now abandoned), and a part of the naval arsenal adjoining Detroit in the northeast section. The arsenal is now idle and most of the machining equipment is still in place, presumably waiting to be declared surplus. Reports indicate Buick may build its own version of the transmission, since it has a large transmission plant in Flint which probably could handle the project.

Pontiac foundry expansion project continues to progress slowly, with equipment suppliers exasperated over repeated delays occasioned principally by conflicts between different union groups engaged in the erection and testing work. For example, the electricians will only do this, the millwright will not touch that, the plumbers will do only that, and production workers won't lay a hand on anything. This jurisdictional cleavage is nothing new, but it borders on the nonsensical in trying to fit together a new plant project and get it running smoothly.

The new cupolas lined to 108-in. inside diameter have been placed in operation and the four units in the old battery are being relined to 102-in. diameter. Banks of castings were built up so the switchover caused no interruption to final assemblies. A new sand distributing system also is now in operation.

* * *

ADVERTISEMENTS appearing in the trade press offering capacity for "quantity production" of gray iron castings by the Wheland Co., Chattanooga, Tenn., recall the extensive program of expansion and modernization recently completed at this plant for production of Chevrolet brake drums. It is reported in the trade that most of the equipment program was underwritten by General Motors on the basis of a four-year amortization out of production. Three castings lines have been set up for production of drums and other small parts which Chevrolet Gray Iron Division in Saginaw has transferred to the new supplier so it could concentrate on output of heavier castings in larger quantities. Apparently a fourth line is being installed in the Wheland plant, which could supply other customers. Ample cupola capacity is available to furnish iron to the four lines.

Incidentally, superintendent of the Wheland foundry is Karl H. Landgrebe, who worked for a short time a few years ago in the Ford foundry here. He is the son of Karl Landgrebe, retired president of Tennessee Coal, Iron & Railroad Co. in Birmingham, Ala.

BRAZILIAN FOUNDRY: Partial view of Fundicao Ararense Irmaos Ruegger, Araras, Est. São Paulo, C. P., Brazil—one of the modern foundries in Brazil

Gray Iron Founders To Meet Oct. 2-3

Annual meeting of the Gray Iron Founders' Society will be held at the Schroeder Hotel, Milwaukee, Oct. 2-3. The program will feature speakers of national prominence dealing with subjects of particular interest to the members of the society. Howard A. Stockwell, Barbour-Stockwell Co., Cambridge, Mass. and president of the society, will preside at the general sessions.

One feature of the program will be the report by Raymond A. Collier, executive vice president, on the survey of the gray iron foundry industry being undertaken by the society. To date well over 500 replies to the survey questionnaire have been received and over 100 have included from one to four page letters discussing in detail problems of the industry.

On the day preceding the opening of the convention, the retiring board of directors will meet, and on the afternoon of Oct. 3, the new board will hold its organization meeting.

Despatch Expands Sales Facilities

National sales facilities of Despatch Oven Co., Minneapolis, have been expanded by the appointment of six new territorial representatives.

John Wright, Air Comfort Associates Inc., 412 Stanley Ave., Evansville, Ind., and George W. McDaniel, 325 Bankers Trust Bldg., Indianapolis, will handle sales in their respective areas.

Frederic & Baker, 826 Ardis Bldg., Shreveport, La., will have the Louisiana-Arkansas region; William T. Day, Day Engineering Co., 300 Essex Ave., Narberth, Pa., the Pennsylvania-Delaware region, and DeWitt Gunsolus, 267 East Paces Ferry Rd. N. E., Atlanta, territory including Georgia, South Carolina and Florida.

Northern California has been assigned to W. C. Matheson, 151 San Bruno Ave., San Francisco.

Aluminum Co. of America, Pittsburgh, recently held the premier of its new film, "This Is Aluminum," at the Monte Carlo, New York. It described in detail the steps in mining bauxite, as well as the processes involved in refining the ore before it can be reduced electrolytically to metallic aluminum.

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Don't be required to use relief pitching! Be sure that your starting choice will carry the burden for as many innings as competition may demand.

Davenport Molding Machines are known for their ability to start and finish EVERY assignment.

Get your PROBABLE LINE-UP today by writing for the complete Davenport catalog.

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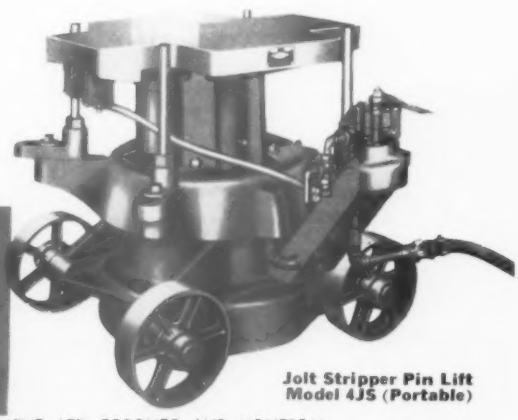
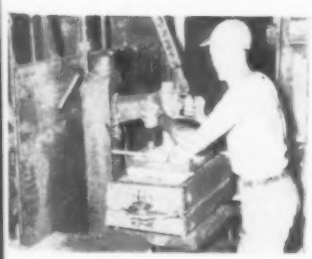


Jolt Stripper Pin Lift Model 4JS (Portable)

CANADIAN REPRESENTATIVES: CANADIAN FOUNDRY SUPPLIES & EQUIPMENT, LTD. TORONTO AND MONTREAL



Jolt Squeezer Model 10-JX (Stationary)

Complete Team of Davenport Installations

Well Balanced Davenport Team

A Place for Your Davenport Line-Up

COST GROUP ACTIVITIES

Extended by Gray Iron Founders

A TOTAL of 255 gray iron foundries now are members of 15 local cost groups sponsored by Gray Iron Founders' Society in various sections of the country. Three new groups, comprising 44 foundries, were formed in recent months on the West coast, the newest of these being the Southern California Group which was organized at a meeting in Los Angeles, Apr. 11, under the leadership of a steering committee headed by Chairman Robert Gregg, Reliance Regulator Corp., Alhambra, Calif.

The Southern California unit of 18 foundries is made up of nine members from Los Angeles and one each from Hollydale, Compton, Bell, Southgate, Long Beach, El Monte, Alhambra and Pomona Calif., and Phoenix, Ariz. The Northwest Group has 16 members, including eight from Seattle, three each from Everett, Wash., and Portland, Oreg., and one each from Tacoma and Hoquiam, Wash. The Northern California Group consists of five Oakland foundries, two from San Francisco and one each from Berkeley, Fresno and Stockton. The wide geographical distribution of these charter members is expected to result in future expansion in size of the groups.

Explains Cost Plan

A. E. Hageboeck, Frank Foundries Corp., Moline, Ill., chairman of the Gray Iron Founders' Society cost committee, was the principal speaker at the organizational meeting in Los Angeles and explained the operation of the local cost group plan as applied to gray iron foundries. He pointed out that it is a simple, practical method that every foundry, no matter how small, can use to figure costs on any individual casting and as a basis for making quotations.

"We have long since taken the position that it is impossible to get true cost on every casting, but we have found, from years of experience, that it is very easy to follow the society method and obtain a practical cost," he declared. "It is a matter of record of over 20 years that those foundries which have used this method have all prospered and have made money.

"The society is interested in helping top management to merchandise its product so as to build a reserve in good times, to carry the load through a depression and also build reserves to improve plant facilities to make the foundry an attractive place in which to work and, incidentally, to pay a return on the money invested in the business.

"How can this be accomplished? As a first step, it becomes necessary to provide all important foundries with a uniform cost method and a costing formula that will enable them to make intelligent quotations. The society cost committee has worked on the problem of reaching foundries in all sections of the country and has come to the definite

ROBERT GREGG

conclusion that this can be done only by group action on a local basis.

"From a cost angle, we class gray iron foundries—both jobbing and captive—in two major classifications: Those which do not have good records and, consequently, do not have a reliable costing formula, and foundries which today have a good cost system and a reliable pricing formula.

"A foundry without good cost records is like a ship without a rudder. It cannot be steered, it just floats, and we have some stormy sea ahead. The time is just ahead when all jobs will be checked by casting buyers, and you will find that you get repeat orders on all items that are in the red, but the jobs now in the black will be whittled down until the whole operation loses money. What is needed is this simple, practical costing formula, based on current costs of labor and material, including an item for anticipated increases, when making quotations on future deliveries.

"The cost committee has found that foundries which had sound costing when they joined one of our groups have proved to be some of our most enthusiastic members. They want their competitors also to know their costs and thereby make intelligent quotations. This fact alone makes our program thoroughly worthwhile. But you probably cannot compare the costs of a foundry which now has a good system or make a breakdown of departmental costs with those of other foundries because no other foundry figures its costs in exactly the same way. However, the collection of this information by an industry-recognized cost consultant results in a breakdown showing each foundry's unit costs, overhead ratios, man-hour statistics and other data on a uniform basis for each of the foundries included in the group.

"Many of our local cost groups also have found that top management has gained much by informal, round-table discussions after the current 'blueprint' of costs has been reviewed. Considerable benefit is derived through obtaining the collective viewpoint of foundrymen.

"Pertinent facts regarding the program are these: The cost principles used are not new, being over 20 years old. Membership in the society is not necessary to become eligible to join a cost group. In most cases additional clerical help is not needed in adopting the program because the information already available will answer the cost consultant's questions. No other foundry will have access to your cost figures.

"Group action is the only practical method of educating the small foundries who do not have sound costs, but who are a factor in the market for gray iron castings. For best results we must have the support and participation of all important foundries in an area, both jobbing and captive."

NUMBER OF FOUNDRIES IN GRAY IRON COST GROUPS

Eastern States
15—New England
16—Eastern Pennsylvania
15—Western New York

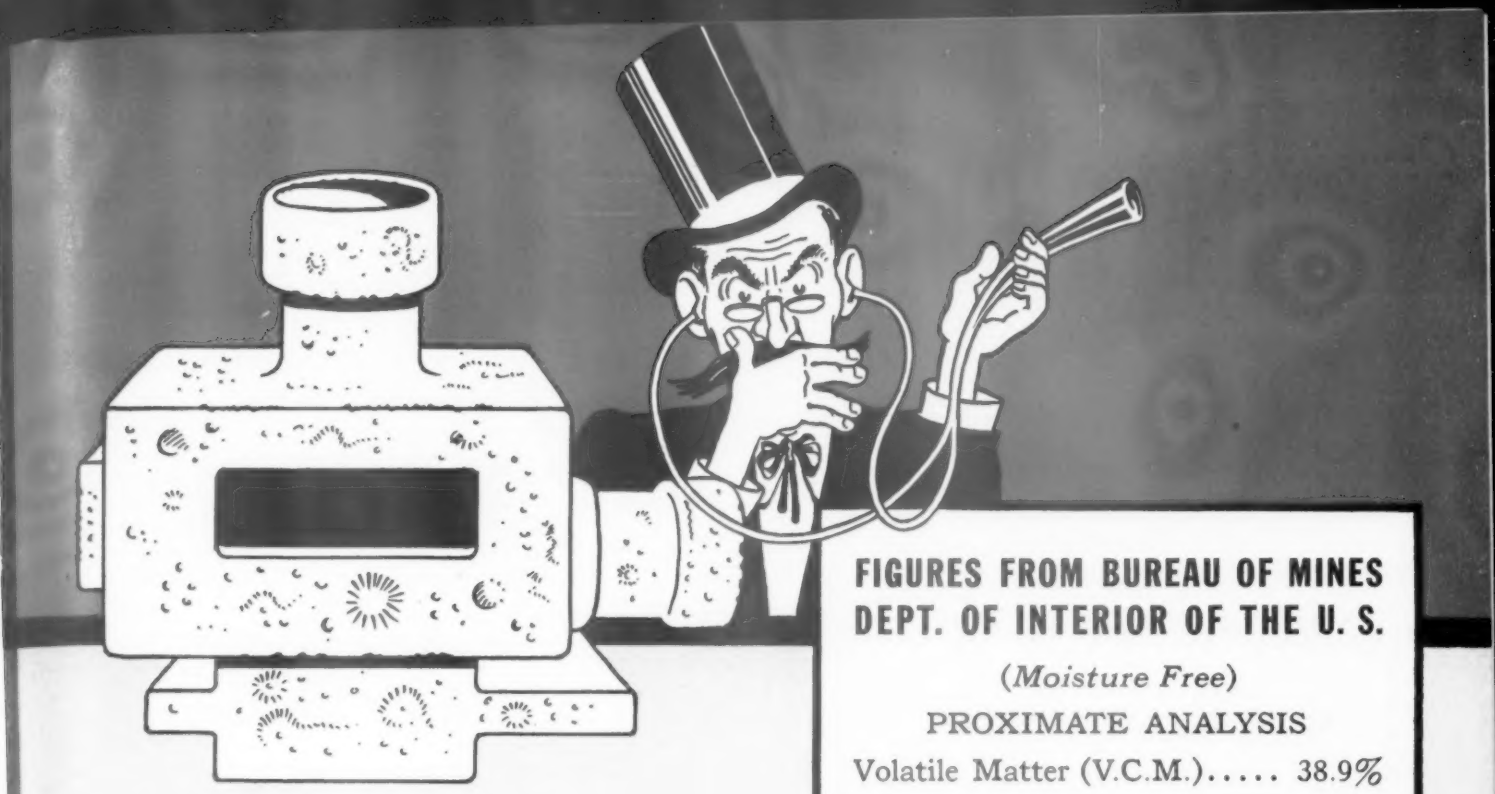
Central States
8—Western Pennsylvania
15—Northern Ohio
14—Southern Ohio
18—Michigan
15—Northern Indiana

Midwest States
12—St. Louis
28—Iowa-Minnesota
28—Chicago
27—Wisconsin

Pacific Coast States
16—Northwest
10—Northern California
18—Southern California

ISA Plans Meeting

Instrument Society of America, 1117 Wolfendale St., Pittsburgh, will hold its second annual conference and exhibit at Hotel Stevens, Chicago, Sept. 8 to 12. Over 90 manufacturers of instruments and devices for measurement, inspection, testing, and control have already signed up to exhibit their latest developments.



FIGURES FROM BUREAU OF MINES DEPT. OF INTERIOR OF THE U. S.

(Moisture Free)

PROXIMATE ANALYSIS

Volatile Matter (V.C.M.)	38.9%
Fixed Carbon	57.4%
Ash	3.7%
	100.0%

ULTIMATE ANALYSIS

Hydrogen	5.4%
Carbon	82.0%
Nitrogen	1.6%
Oxygen	6.6%
Sulphur	.7%
Ash	3.7%
	100.0%

Fusion Point of Ash....2,780°F.

HM-M-M! BLISTERS, SCABS, BLOW-HOLES, ROUGHENED SURFACES AND OTHER SKIN DEFECTS! TRAGIC CONDITION! PARTICULARLY WHEN IT'S SO EASY TO CURE, SIMPLY BY USING...

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Seacoal Plant — Mines

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IN TWIN CITIES: The Foundry Supply Co., Inc., 2295 University Ave., St. Paul 4, Minn. IN SOUTHWEST: Beaumont Cement Sales Co., Houston & Beaumont, Texas, and Harvey, La.

Foundry Developments

By EDWIN BREMER

CONTRIBUTION to the search for better metals and byproducts of his metallurgical studies is the new grain size comparator developed by F. C. Hull, Westinghouse Research Laboratories. Consisting of a ground-glass screen hinged to an illuminating unit with a slotted wooden frame, it is attached easily to a standard metallographic microscope as indicated in the accompanying illustration. It permits counting the grains in a certain area or estimating their extent by comparison with a series of standard photographs. To determine grain size the polished and etched specimen is placed on the microscope stage and projected in magnified form on the glass screen. A transparent slide of a known, standard grain structure is slipped into the wooden frame and illuminated by incandescent light. Magnifying power of the metallograph is changed by extending the bellows until the grain size of unknown image matches that of the standard. Amount of adjustment is read from a scale on the camera, and grain size of the unknown specimen determined by reference to a standard graph. Grain structure of metals is a most revealing clue to their qualities. Relatively large grain size may produce superior rupture and creep strength, whereas in the same metal fine grains structure may give greater tensile strength, ductility, or endurance. Knowledge of controllable grain size is vital "evidence" in metallurgical problems.

* * *

INVESTIGATION of melting monel metal in an indirect arc furnace by B. N. Ames and N. A. Kahn indicated that ionization of the furnace atmosphere during melting materially accelerates the amount of gas absorbed. That gas when rejected during solidification results in porous or leaky castings. It also was found that magnesium was not effective in providing sufficient deoxidation and degasification, but such elements as titanium, lithium and zirconium functioned effectively.

* * *

SODIUM metasilicate pentahydrate serves excellently as an alkaline immersion cleaner for rust-resistant phosphate coated metals, according to a report now on sale by the Office of Technical Services, Department of Commerce, Washington 25, D. C. Prepared by S. G. Newman, Springfield (Mass.) Armory, U. S. Army Ordnance Department, the report states that the pentahydrate at a concentration of 6 to 10 oz per gal water will not harm protective phosphate finishes. At a concentration of 6 oz per gal the solution does not corrode light metals or zinc die castings. Degreasing effect of alkali immersion cleaners is improved considerably by addition of alkyl aryl sulphonate, a surface active agent. Addition of 10 per cent sulphonate to the pentahydrate solution gives best results. Immersion for 10 minutes at 205 to 210 F is recommended. Report is designated PB-49262, "Alkali Degreasing Solutions" (photostat $3, microfilm $1).

* * *

SULFOSALICYLIC acid and a colorimetric used for the determination of iron in light metal alloys shortens considerably the time required in analysis, according to a report available from the Office of Technical Services, Department of Commerce, Washington 25. Colorimetric method avoids the separation of iron as required in the procedure of titrating ferrous ions with permanganate. In the colorimetric analysis a small amount of the light alloy is dissolved in an acid solution, and when it is combined with specially prepared sulfosalicylic acid the presence of iron causes the solution to turn red. Amount of iron is measured by using an electric colorimeter with a green filter. Test is said to work satisfactorily in the presence of aluminum, magnesium, silicon, copper, zinc, lead, cadmium, antimony and manganese. Report is PB-53890; Colorimetric Iron Determination in Light Metals Using Sulfosalicylic Acid; photostat $1; microfilm $1; limited supply mimeographed 50 cents.

* * *

INTERESTING pamphlet which should be in the hands of every foundryman has been published recently by the U. S. Department of Labor. Entitled "Employment Outlook in Foundry Occupations" the pamphlet contains 55 pages with the contents divided into two parts. Part 1 discusses the outlook for foundry employment under such headings as foundry products and processes, economic characteristics of foundry operations, trends in foundry production and employment, outlook for production of castings, technological trends affecting employment, and employment outlook. Part 2 is more specific, dealing with employment outlook for various operators such as molders, coremakers, patternmakers, etc., and discusses work, qualifications and training and earnings. Copies of bulletin No. 880 may be obtained from the Government Printing Office, Washington 25, for 15 cents each.

* * *

FIRST, second, third degree and x-ray burns are claimed to be healed quickly and in most cases without any scars, by a recently developed sulphur compound called "Hydrosulphosol." According to its manufacturer the product relieves pain by forming an air-tight film over the burn area. It is termed a safe nontoxic remedy for burns of all types including those caused by lye, grease, open flame or acids.

New grain size comparator used in connection with standard metallographic microscope to determine grain size of metal specimens

least handled . . . is best handled

Logan Roller Conveyor is basis for all movement in cylinder head department of nationally famous motor manufacturer. Castings are inspected on the conveyor, and various machine operations are performed on equipment paralleling the line of travel. Part of a comprehensive Logan system in this efficient plant.

"That country is best governed — which is governed the least" say our leading statesmen. The handling of materials and products in your plant offers a striking parallel to the above statement. That product which is subject to the least manual handling—is best handled, is produced at the lowest cost, with the greatest savings in time, effort, space, and also with the most employe satisfaction. The purpose and goal of every Logan Conveyor engineer is to pare down costly manual handling to the bone, to reduce the number of "pick ups and lay downs" of work in process, substituting that profitable "flow" of movement, so highly desired today.

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PRESERVE FREE ENTERPRISE

Logan Conveyors

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AFA SESSIONS DEAL WITH CASTING DEVELOPMENTS

(*Continued from page* 97)

erties of Medium-Carbon Low-Alloy Cast Steel," prepared by J. G. Kura and H. N. Keyser, research engineers of the institute.

In presenting the paper, Mr. Kura said that notched-bar impact properties and hardenability of medium-carbon, manganese-molybdenum cast steels produced by eight different melting practices were investigated. Three of the practices identified as basic, fully oxidized and blocked; basic, fully oxidized, blocked and finished under a reducing slag; and acid, fully oxidized and blocked, were studied more extensively.

The principal influence of melting practice on the notched-bar impact properties appeared to be through control of the sulphur content and sulphide distribution. In general, Mr. Kura continued, if sulphur content increased or sulphides were found as a network pattern in the grain boundaries, the notched-bar values were low.

Lower In Impact Value

In the tests, the acid steels were generally lower in notched-bar impact values than steels produced by the basic practices, this difference apparently being related to the higher sulphur content of the acid steels. Variations in hardenability in some steels could not be accounted for by the chemistry of the steels. However, there appeared to be no distinction or consistent influence of any one type of melting or deoxidation practice on hardenability, provided the metal is sound, and the quantity, size, and distribution of the inclusions, the composition of the steel and its microstructure are substantially the same.

"Influence of Selenium on Sulphide Inclusions and Ductility of Cast Steel" was the title of a paper presented by Albert P. Gagnebin, metallurgist, research laboratory, International Nickel Co. Inc., Bayonne, N. J. The problem of obtaining globular, randomly dispersed sulphides in well-killed cast steels has been recognized for years, he stated. Now iron oxide contents which favor freedom from blowholes during solidification tend to promote thin, intergranular sulphides detrimental to ductility—but also increase the susceptibility to gasiness. Consequently, it is difficult to produce sound, ductile cast steel not deoxidized in any special manner, because its quality is partly dependent on the degree of oxidation at the time the steel is poured. This factor cannot readily be determined.

Mr. Gagebin's paper presented a new deoxidation procedure involving use of selenium, which has been found to promote sulphide coalescence under a variety of conditions. It consists of ladle addition of 0.08 per cent calcium and 0.05 per cent selenium. In addition to refining the grain, selenium has the specific ability to coalesce the intergranular sulphides in low-oxide, well-killed cast steel, and thereby to improve its ductility.

Extensive tests in laboratory and commercial heats, the author reported, show that calcium selenium promoted high ductility in steels ranging from 75,000 to 180,000 psi tensile strength and melted in acid electric, basic electric and basic open-hearth furnaces. Calcium selenium promoted better ductility and was less likely to produce heats of low ductility than other methods of deoxidation.

Second steel session was conducted Wednesday morning, with C. H. Lorig, Battelle Memorial Institute, Columbus, O., presiding, and E. C. Troy, Dodge Steel Co., Philadelphia, the co-chairman.

In the first paper, "Slag Control in the Acid Electric Furnace," H. H. Johnson, metallurgist, M. T. McDonough, melting superintendent, and D. L. Radford, alloy chemist, National Malleable & Steel Castings Co., Sharon, Pa., pointed out that in the melting of steel there are certain criteria by which the melter can judge the condition of the metal during the several stages of the melting operation. One of the most important of these in basic open hearth practice is based on appearance and measurements of certain properties of the slag as they change during the working of the heat.

In the field of acid furnace practice, both open hearth and electric, study of the slag reactions has received only superficial attention until recent years, so that slag measurements and slag control are not as useful tools for acid practice at the present time as they might be. Recently, considerable work has been carried out in the field of acid open hearth practice by the Acid Open Hearth Research Association and many of its findings have been published.

In abstracting the paper on which he and his associates had collaborated, Mr. Johnson presented the results of a study of some of the characteristics of acid electric furnace slags, together with some applications of these characteristics to serve as a guide for such furnace practice.

Some attempts at the application of slag measurements to control of several steps in the process indicate: (1) That such measurements may be useful as an indication of the probable manganese recovery obtained; (2) that they provide a measure—which can be incorporated in the form of quality control charts—to assist in directing the technique employed by several melters and to form a basis for comparison of the performance of several melting units; (3) that they afford an excellent indication as to the progress of the heat and serve as a guide on how to proceed with the working of the heat; (4) that there is some correlation between slag characteristics and the physical properties of the metal produced.

In discussion of this paper, Co-chairman Troy pointed out that tests of steel in the bath are only as good as the samples taken. Operators must be warned and warned repeatedly to push back the slag before dipping out the sample metal. Improvement always is noticed after operators are cautioned.

Compare Processes

"Application of a Single Slag Process to Basic Electric Steel" was the subject of a paper contributed by M. V. Healey and R. W. Thomas, General Electric Co., Schenectady, N. Y., and presented by the former. In a comparison of molybdenum alloy sand castings of basic electric steel, it was noted that the basic open hearth product had certain desirable metallurgical characteristics that were absent in the basic electric product made by the double slag process. Improvement in basic electric steel was accomplished by thorough boiling and the elimination of the reducing slag.

Mr. Healey stated that among conclusions which appear to be justified are the following: (1) The reducing period in the basic electric furnace performs no useful function in steelmaking except possibly that of recovering oxidizable alloys from the slag; (2) some reduction in the cost of a heat is accomplished by elimination of the reducing period; (3) the single slag process is not a guarantee of freedom from pinholes if mold conditions are to be ignored. It is the opinion of the authors that this process produces metal of lower gas content than does the double slag process. How much lower is not known; (4) measurement of gases in liquid metals is necessary if the tendency of the metal to form pinholes is to be evaluated.

Two papers were presented at the Thursday morning steel session, with J. A. Rassenfoss, American Steel Foundries, Indiana Harbor, Ind., presiding.

First of the papers, "Occurrence of Intergranular Fracture in Cast Steels," by C. H. Lorig and A. R. Elsea, Battelle Memorial Institute, Columbus, O., was presented by Mr. Lorig. The paper was based on work done between 1942-1944

(*Continued on page* 125)

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(*Continued from page* 122)

to determine defects in armor plate and was intended as a survey of the causes of intergranular fracture in test specimens.

Fracture surfaces were found to be primary austenite grain boundaries established at the time of casting. Prime causes of this intergranular fracture were identified as follows:

1. Aluminum nitride precipitation at primary grain boundaries. Precipitation is controlled by the aluminum and nitrogen content and cooling rate after casting. Tendency toward intergranular fracture was decreased through use of titanium, zirconium, silicon, boron, copper or molybdenum.
2. Ferrite precipitation as a network on primary grain boundaries. Heat treatment, however, eliminates such a network.
3. Carbide precipitation at primary grain boundaries.
4. Extreme cases of type 2 sulphide inclusions.
5. Internal hot tears.
6. Chain-like precipitate of some unidentified compound.

Tests Show Different Results

It was also determined that an increase in sulphur decreased susceptibility of steel to intergranular fracture. Tests tried on commercial steels did not come out the same as in laboratory steels because of the difference in aluminum content.

During the discussion period it was brought out intergranular fracture does exist if aluminum is not added. Such fracture occurs any time grain body constituents are different from the matrix. As to the effect of intergranular fracture on strength, it was pointed out that tensile and yield strength are unaffected up to 25 per cent intergranular fracture but ductility is.

The second paper, "Segregation in Small Steel Castings," by H. F. Bishop, Naval Research Laboratory, Washington, and K. E. Fritz, Bucyrus-Erie Co., South Milwaukee, and formerly with Naval Research Laboratory, Washington, was presented by Mr. Biship.

Mr. Bishop stated that carbon segregation is usually associated with large castings, but it has been found that it exists also in small castings weighing only a few pounds. There is also a minor segregation of other alloying elements. Such segregation results in hard spots sometimes encountered in machining operations.

Greater segregation was found in the casting below the riser neck where the

Additional views of participants in the "Ford Day" inspection trip at the Rouge plant

MAN-TO-MAN
on the Molder's Bench

"Rules, Locks and Chicken Wire"

By RALPH L. LEE

AFTER reading over a number of employee rule books some time ago the following incidents came to mind.

Down in Washington Court House, O., many years ago there used to be on the cigar counter in the lobby of the Cherry Hotel an open cigar box with stamps and money in it. Anyone who wanted a stamp could help himself and make his own change. The fellow who ran the cigar counter told me that in all the years he had been there, there had not been one single closing time in which he had not found more money in the box than there should have been.

In front of one of the largest office buildings in the country, any evening near quitting time, will be seen a long line of people in single file waiting their turn to get on a bus. Some evenings the string is so long it has to double back on itself several times to stay on the sidewalk. There is never a cop in sight, not even a bus starter. Once in a great while some unprincipled pup pops into the bus out of turn. But so far there haven't been enough of these to discourage the others.

I once heard of a junk dealer who made a fortune in spite of signing blank checks for his customers to fill in. His son told me that when loaning money, which he did frequently, he would be insulted if he was offered a note or an I.O.U. "If you are not going to pay," he would say, "what good is the piece of paper, and if you are I won't need the paper."

I would, of course, be willing to bet that every once in a while the old man would get stung by one of those cookies like the bus bum who wouldn't wait his turn. Neither would I be surprised if there were certain stamp buyers who short-changed the cigar box. But there can be little doubt that of all the people involved in these stories there couldn't have been over one out of twenty who was crooked. Furthermore, those who could be trusted more than made up for those who couldn't.

Sometimes I wonder whether the cost of all the safeguards some set up against the relatively few who can't or won't behave isn't clear out of proportion to the actual damage they do. Maybe an examination of the records, the receipts, the countings, the checkings, the locks, the chicken wire on cribs, the guards, the clocks, the signs and the posted rules would uncover some at least that cost a darned sight more than they are worth.

But of one thing I am positively convinced—if, in an effort to sift out the few who can't be trusted from the 95 per cent who can, we force all to pass through the screen of suspicion, we are bound to lose. The money we save as a result of the screening, in my opinion, will be only a drop in the bucket compared to what we lose through the half-hearted efforts and luke-warm loyalty of innocent people who are forced to work under suspicion.

While I would be the last one on earth to suggest that we throw away all our locks and safeguards, I know that we usually get what we expect from the rank and file. Maybe the time is ripe for a flyer in expecting the best. I, for one, believe it will pay good dividends.

riser contact was small. Segregation decreases with increasing neck diameters and decreasing core thicknesses. This indicates that segregation is more prevalent when feeding castings through restricted areas such as in necked down risers, Washburn or knock off risers.

In castings where such segregation occurs, it was concluded that during the latter stages of solidification the riser contact consists of solid low carbon dendrites surrounded by liquid high carbon metal. To fill the feed demand of the casting the high carbon metal flows down to form the segregated area.

It was determined that in steel having a base analysis of 0.25 per cent c, the segregated zone may contain 0.45 per cent c. Commercial annealing treatments were ineffective in dispersing such segregation. Mr. Bishop pointed out that the severity of segregation in castings can be reduced by pouring with hot metal and by using oversize risers.

In a prepared discussion, J. B. Caine, Sawbrook Steel Castings Co., Cincinnati, commented that the reason segregation doesn't occur in all commercial castings may be due to casting design. The relation between the riser area and the casting area is important. Increasing riser section tends to reduce segregation. Castings with low surface-volume relations give more segregation than those with high surface-volume relations.

The controversial subject of venting molds for steel castings precipitated a lively discussion following the steel round-table luncheon meeting Thursday under the joint chairmanship of Fred Melmoth, former vice president, Detroit Steel Castings Co., and John Howe Hall, foundry consultant, Swarthmore, Pa. Many steel foundrymen hold to the theory that molds must be vented up through the cope to let air out. They reason that unless the pressure, presumably built up and progressively increased during pouring, is relieved, it will become so great as to arrest the inflow of metal before the mold cavity is filled, causing premature solidification.

Members of the second school point out that light sectioned castings weighing little more than 1 oz each, with as many as 20 on a gate, are being run successfully without venting. Others with 3/16-in. sections and extremely great surface areas, made on jolt squeeze ma-

(*Continued on page* 128)

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chines in slip flasks, are cast regularly with no appreciable increase in missruns. Molds properly poured with metal hot enough to run work of this character, and gated to keep liquid metal moving actively, are not influenced by any provision of additional mechanical venting. Nor is additional mechanical venting necessary to insure the running of the castings, or to allow any mold cavity to run full and sharp at any point, provided sand permeability is over 40 AFA.

Two papers dealing with various phases of metal temperatures were presented at the concluding steel session under the joint chairmanship of J. B. Caine, Sawbrook Steel Castings Co., Cincinnati, and C. K. Donoho, American Cast Iron Pipe Co., Birmingham. The first paper by G. Vennerholm and L. C. Tate, Ford Motor Co., Dearborn, Mich., considered the determination of molten metal temperatures. The second paper, by M. C. Udy and H. O. McIntire, Battelle Memorial Institute, Columbus, O., was presented under the title "Temperature Distribution in Metal Molds."

Authors of the first paper pointed out that the whole refining process in steelmaking is based on a series of chemical reactions, which largely are a function of the temperature. Degree of solubility of the various gases present—oxygen, nitrogen, hydrogen, etc.—also is governed by the temperature. Accurate determination of liquid metal temperatures is essential to control melting operations. Generally, temperature measuring instruments for foundry use must be accurate within approximately plus or minus 10 F. These instruments must respond quickly to temperature changes, must be rugged and portable and should have low initial and low maintenance costs. Operation should be simple and the instruments must be recording as well as direct reading. Several methods of measuring temperature which approach these qualifications are available. The paper discusses their use and behavior under plant conditions.

Authors of the second paper explained that it is based on work done under contract between Battelle Memorial Institute and the Office of Scientific Research and Development. The research was undertaken to determine the advisability of using molds thinner than those usually employed in centrifugal molds, for steel castings. Substitution of thinner wall molds for centrifugal castings and the use of air or water to cool these molds sometimes are desirable.

In general, the conclusions are that thinner molds with air or water cooling could be used to advantage and that to secure maximum advantage from water cooling and higher conductivity mold material, it would be desirable to incorporate an effective thermal barrier on the hot side of the mold.

HEAT TRANSFER SESSIONS

Attract Interested Audiences

HEAVY attendance marked the two sessions devoted to discussion of heat transfer and work of the association's Heat Transfer Committee. Work in prospect by this committee as detailed in the annual report by its chairman, Harry A. Schwartz, National Malleable & Steel Castings Co., Cleveland, concerns a study of the heat conductivity of sands and mixed grain sizes, the completion of the comparisons between the heat flow analyzer work and the laboratory work on the freezing rate of cast iron and aluminum, and an extension of the work begun by Victor Paschkis, Columbia University, New York, on an approximate equation for steel castings in connection with studies on solidification of castings.

At the first session, Tuesday morning, presided over by Dr. Schwartz and E. C. Tray, Dodge Steel Co., Philadelphia, Dr. Paschkis described the electrical equipment used in his laboratory in the study of heat flow. In an AFA paper presented in 1944 Dr. Paschkis first suggested that heat and mass flow analyzer techniques might well be used to solve complicated foundry heat flow problems. With these techniques heat flow is simulated under a given set of conditions by using electricity and appropriate electrical circuits.

One of the tests being conducted in foundry laboratories using molten metal to check the electrical analogy method has been carried out by the Cleveland Research Division, Aluminum Co. of America, and H. Y. Hunsicker of that company reported on its studies of aluminum solidification rates in dry sand molds. Castings in which a solid shell of measurable thickness could be retained in the mold were produced using 99.8 per cent aluminum cast in the form of 2 x 12 x 12 in. plates in 10 x 15 x 16 in. baked sand molds. Average thickness of the solidified layer was found to approximate $0.0367\sqrt{t} - 0.11$, where t is time interval in seconds.

This relation appears to be in good agreement with that predicted on the basis of heat transfer calculations assuming a constant temperature at the casting-mold interface throughout the solidification period. Extrapolation indicated that a time interval of approximately 9 seconds after pouring was required to dissipate the superheat of the liquid metal, approximately 80 F, before solidification started, and that complete solidification required approximately 915 seconds. Solidification rates ranging from 6.12×10^{-3} in./sec at the start of solidification to 6.07×10^{-4} in./sec just prior to completion were derived from the data.

The concluding paper at this session, "Calculating the Size of Gates and Risers," was presented by Nathan Janco., the Centrifugal Casting Machine Co., Tulsa, Okla. It described a method for determining gate size through use of what is known as the cooling factor. This factor, which is a measure of how quickly the metal will solidify, is expressed as the ratio of the area of the largest section of the casting to the perimeter of that section. By making the cooling factor of the gate slightly larger than that of the casting, adequate feeding will be provided, it was stated. Subsequent discussion from the floor took exception to general application of this method of calculation, the opinion being that while it might prove suitable for simple castings of fairly regular contour, it is not adaptable to heavy, chunky work.

Howard F. Taylor, Massachusetts Institute of Technology, Cambridge, Mass., and Walter Klayer, Aluminum Industries Inc., Cincinnati, presided as co-chairmen at the second session on heat transfer, Tuesday evening, at which four papers were presented. The first by Harry A. Schwartz, National Malleable & Steel Castings Co., Cleveland, dealt with "Freezing Rate of White Cast Iron in Dry Sand Molds," and indicated that iron freezes somewhat rapidly for the first three minutes; then the deposition of solid metal slows up until about five minutes after pouring when the deposition suddenly accelerates, the dendrites meeting in a little over seven minutes. However, over 45 minutes are required for the center to freeze completely.

Second paper by C. F. Lucks, O. L. Linebrink and K. L. Johnson, Battelle Memorial Institute, Columbus, O., on "Thermal Conductivities of Three Sands," was presented by Mr. Lucks, and described data obtained on sands of which one contained 100 per cent on minus 20 to plus 30 mesh; another 99 per cent on minus 50 to plus 70 mesh, and the third 93 per cent on minus 80 to plus 120 mesh sieves. Thermal conductivities of the first sand at 750 and 2250 F were found to be 3.0 and 8.8 Btu/hr/sq ft/in./°F respectively, while those of the second sand at 750 and 2250 F were 2.6 and 5.2 Btu/hr/sq ft/in./°F. Conductivities of the third sand at 750 and 2250 F were 2.1 and 3.2 Btu/hr/sq ft/in./°F, respectively.

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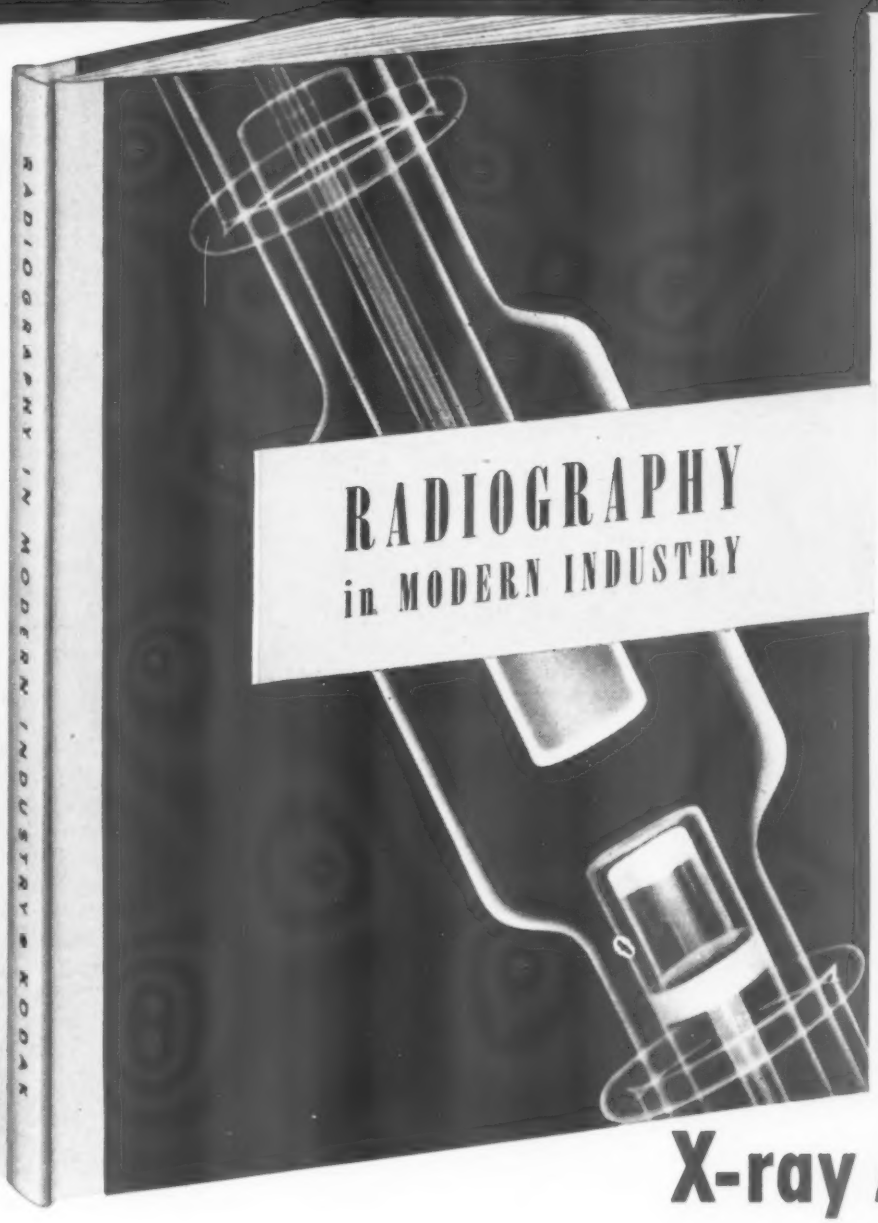

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(*Continued from page* 128)

Victor Paschkis, Columbia University, New York, presented the third paper, entitled "Influence of Properties on Solidification of Metals," which discussed the investigations conducted so far on heat transfer by the electric analogy method. He summarized the tests as follows: Pouring temperature (superheat) has a marked influence on start and end of solidification. Solidification range influences beginning and end of solidification an appreciable amount. Specific heat is the determining factor as far as times for start of freeze are concerned, but has less influence on times for end of freeze. Heat of fusion has a relatively small influence on start of freeze and a large influence on end of freeze. Of the three thermal properties, the conductivity has the smallest influence on solidification times. Pouring temperatures are a question of production technique and it is important to determine accurately the specific heat and with reasonable accuracy the solidification range and heat of fusion.

Concluding paper by A. F. Faber Jr., H. B. Salter Mfg. Co. Marysville, O., and D. T. Doll, Case Institute of Technology, Cleveland, described an investigation on "Feeding of Metal Castings," and was presented by Mr. Faber. Work was conducted on brass poured into a plaster mold, and an effort made to determine the relationship between the riser, feeder and casting. Results indicated that the rate of heat flow between shrinkbob or feeder and casting should not be too fast or solid castings will not be obtained.

FINISHING AND INSPECTION

Topic at Malleable Sessions

AT THE opening malleable iron session Monday under the joint chairmanship of Carl F. Joseph, Central Foundry Division, General Motors Corp., Saginaw, Mich., and W. D. McMillan, International Harvester Co., Chicago, a paper on malleable iron finishing and inspection was presented by T. E. Paulson, Belle City Malleable Iron Co., Racine, Wis. The author reviewed steps and procedures for delivering a satisfactory product, beginning with raw casting after pouring and following through the cleaning, finishing and inspection operations.

The speaker pointed out that the finishing phase of foundry operation is not scrutinized as closely as the melting, core and molding departments from the cost standpoint. In the majority of malleable plants the castings first are taken to the hard mill room where they are tumbled. In the plant with which the author is connected, hard iron milling was eliminated several years ago. The operator takes the castings from the trucks and removes fins, cracking strips and excess material with a hammer. Defective castings are rejected and good castings are placed directly in annealing pots on the floor.

Weight of castings in the pot, which is 19½ x 27½ in. and 17 in. deep, varies between 350 and 400 lb. The pot weighs approximately 480 lb. A small amount of packing material in some pots is supplied from a hopper, picked up and manipulated by an overhead crane. The filled pots are stacked four high by a crane. Joints are sealed with mud. The stacks are loaded on a car with a capacity of 24 pots which forms part of a train going through a continuous type oven where the castings are annealed.

The remainder of the paper dealt in detail with methods and equipment for handling the castings through the finishing and inspection departments. Substantial saving has been effected by equipping the grinding stands with a foot pressure attachment which presses the casting against the wheel.

At the same session E. M. Strick, Erie Malleable Iron Co., Erie, Pa., in a paper entitled "Malleable Finishing" pointed out that many cleaning and finishing costs could be reduced by greater co-operation between designer, pattern, molding, melting and finishing departments. The speaker claimed that considerable controversy exists on the advantages and disadvantages of cleaning castings in the hard iron stage. Many good arguments have been advanced for and against the practice. In a general jobbing foundry with a wide variety of castings requiring close tolerances, gaging, and exceptionally good appearance, hard iron cleaning is essential. On long running jobs with low scrap loss, the practice may be discontinued.

In the speaker's opinion, inspection as a function should be divorced entirely from any other operating functions. The chief inspector should report to the general management or to the general superintendent rather than be under the jurisdiction of the foundry or finishing departments. This sets up a function which can be quite independent and impartial, highly essential features in inspection operation.

Two papers were presented at the Monday afternoon malleable iron session presided over by J. A. Durr, Albion Malleable Iron Co., Albion, Mich. In one paper, good methods of material handling in a malleable foundry processing department were outlined by N. J. Heinke, Saginaw Malleable Iron Division, General Motors Corp., Saginaw, Mich. The description covered methods of moving castings within the department, rough and finish storage, operator fatigue, and working conditions. Methods included belt conveyors, trucking, magnetic cranes, and manual labor. A number of slides illustrated the methods and principles of application. Many comparisons of effective and ineffective methods were introduced to lend emphasis to the claims advanced.

A paper entitled "Mechanized Malleable Foundry Finishing and Inspection," by D. F. Sawtelle, Malleable Iron Fittings Co., Branford, Conn., described finishing operations in a mechanized malleable iron foundry, from the stage where the molds are shaken out to the point of shipment.

The barrels are loaded and discharged automatically, also cool and clean the castings before they are discharged onto a conveyor belt which passes the cupolas on the way to the cleaning and annealing room. In the vicinity of the cupolas, the sprue and gates are removed by hand and thrown into bins. The castings continue their journey through the sorting, inspection, grinding, shearing and annealing departments. Passage through the tumbling barrels reduces the temperature of the red hot castings to 120° F as they start a travel on a rubber belt.

Subject of Intensive Study

Third in the series of malleable sessions was conducted on Tuesday morning, with V. A. Crosby, Climax Molybdenum Co., Detroit, presiding, and Milton Tilley, National Malleable & Steel Castings Co., Cleveland, as co-chairman.

First of two papers was titled "An Interpretation of the Constitution of Iron-Carbon-Silicon Alloys" and was presented by J. E. Rehder, metallurgical engineer, Physical Metallurgy Research Laboratory, Bureau of Mines, Ottawa, Canada. Because the ternary system iron-carbon-silicon is the basis of all commercial malleable cast irons and gray cast irons, and is of importance in making steels, it has been the subject of intensive study for many years. The system is complex and only the high iron corner has been delineated.

According to Mr. Rehder, review and correlation of published experimental data leads to the conclusion that iron-carbon-silicon alloys, at least in the range of zero to 4 per cent carbon and zero to 4 per cent silicon, act as though the silicon is all present as dissolved Fe_3Si with the iron and carbon acting as a pure

(*Continued on page* 132)

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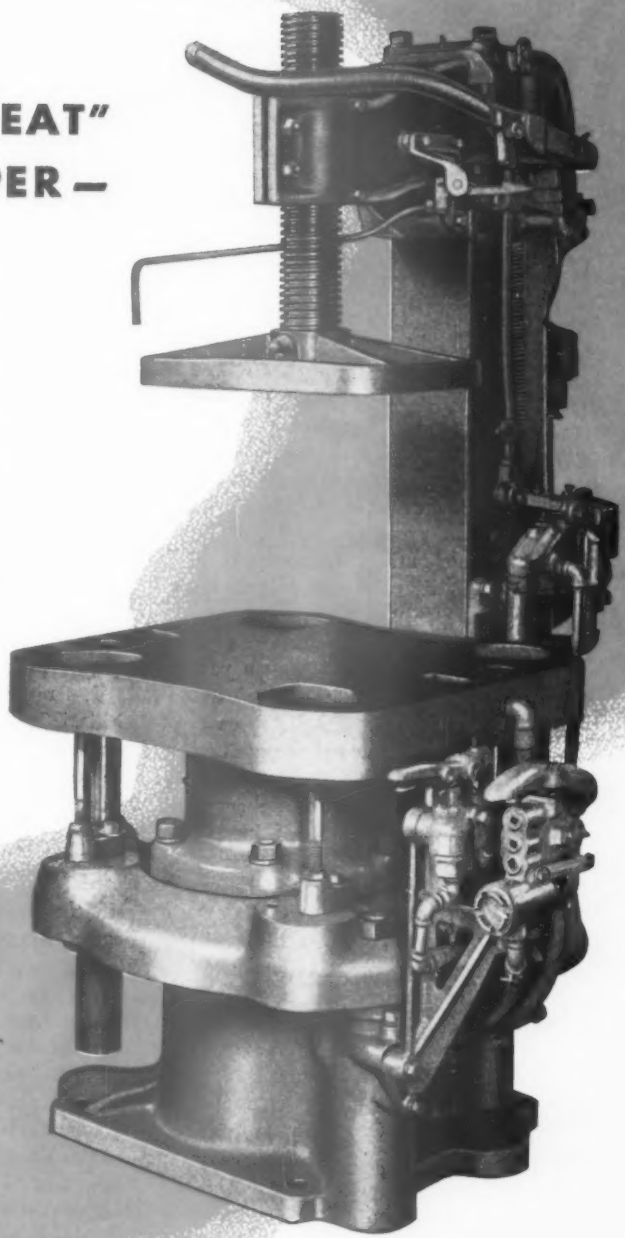

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(*Continued from page 130*)

iron-carbon alloy. The constitution in this range of compositions at least is therefore one of iron-carbon alloys with dissolved Fe_3Si, or Fe_3Si-Fe_3C-Fe. The author suggested that similar reasoning can be applied to the low phosphorus range of iron-carbon-phosphorus alloys.

"Graphitization of White Cast Iron—Effect of Section Size and Annealing Temperature" was the title of the second paper, authored by Richard Schneidewind, professor of metallurgical engineering, University of Michigan, Ann Arbor, Mich., D. J. Reese, metallurgist, development and research division, International Nickel Co., New York, and A. Tang, University of Michigan.

In presenting the paper, Prof. Schneidewind explained that since rate of graphitization is influenced by many factors, it is difficult to measure the precise effect of any one variable, such as cooling rate, for example, unless all other factors and foundry conditions are maintained constant throughout the series of tests. Unless the influence of all the other variables is clearly understood, it is unwise to draw unjustifiably wide conclusions from such a study.

Summarizing results of the research, the speaker stated that a study of time necessary for first-stage annealing of sections of white iron step bars indicated a great effect due to cooling rate of the casting during solidification. Cooling rate was considered to be proportioned to the ratio of volume to surface area of the casting. It was found that the logarithm of this ratio is directly proportional to the logarithm of annealing time and to the grain size of the metal.

GRAY IRON DISCUSSIONS

Cover Numerous Subjects

EFFECT of melting temperature on the chemical and physical properties of gray cast iron was the subject of a paper by E. V. Somers and D. W. Gunther, Trafford Foundry division, Westinghouse Electric Corp., at the opening gray iron session, Tuesday afternoon, presided over by R. G. McElwee, Vanadium Corp. of America, and W. W. Levi, Lynchburg Foundry Co., Radford, Va. The paper was presented by Mr. Gunther and both authors collaborated in answering the many questions from the audience.

Briefly, the authors of the paper began on the assumption or theory that a variation in the amount of oxidation during the melting process is the direct cause of variation in the chemical composition, tensile strength and chill depth of gray cast iron independent of the chemical analysis and the percentage of inoculation. The melting temperature affects the slag composition. Illustrated by a number of charts, the paper detailed the results of an extended series of tests.

General considerations involved in the arc welding of gray cast iron with nickel electrodes were discussed by L. C. Minard and T. E. Kihlgren, International Nickel Co. Research Laboratory, in the second paper. The paper dwelt in considerable detail on the effect of such welding variables as preheat, superimposition of beads in multipass welds, bead sequence, etc., on structural characteristics, machinability and tensile properties of welded cast iron. A preliminary torch degassing procedure was described for improving the welding response of castings containing dissolved gas.

As a result of extensive laboratory tests a nickel electrode to meet cast iron requirements eventually was developed. This electrode consists of a nickel core wire coated with a carboniferous lime type flux, containing a moderate amount of reducing agents. The electrode generally is used without preheating the casting, but special circumstances may make a moderate preheat desirable.

At the gray iron session held Wednesday morning with B. P. Mulcahy, Indianapolis, and H. W. Stuart, U. S. Pipe & Foundry Co., Burlington, N. J., as chairmen, H. W. Lownie Jr., Battelle Memorial Institute, Columbus, O., presented a paper prepared in collaboration with D. E. Krause, also from Battelle, on a "Critical Survey of Foundry Coke." The authors discussed the various tests available to determine properties of foundry cokes, and pointed out that such tests do not provide information on which the performance in the cupola can be predicted.

In the discussion Dr. James T. MacKenzie, American Cast Iron Pipe Co., Birmingham, Ala., said one trouble with coke is that while the size may be uniform in car to car, it seldom is that way when placed in the cupola. He also stated that experience with a small cupola indicated that data obtained could not be translated for large cupola operation. Charles Kawin, Chas. C. Kawin Co., Chicago, said be believed that one of the most important factors in results obtained was the human element, and that some variation in coke size is required for best cupola operation.

B. P. Mulcahy mentioned that in the small or baby cupola accurate coke sizing is necessary, and this changes the actual character of the whole coke. He also said that certain of the available tests must be changed for foundry cokes since they primarily are designed for blast furnace coke.

Second paper, on "Thermochemical Analysis of Combustion in a Cupola," by H. E. Flanders, University of Utah, Salt Lake City, Utah, described work leading to the development of two equations by which the heat of combustion and maximum combustion temperature may be calculated. The equations also may be used to estimate the relative effect of preheating blast air or of removing moisture from the blast, on the heat of reaction or the maximum temperature attainable. The author also pointed out that combustion temperature is dependent only on the conditions of reaction and not on the quantity of coke.

Study Graphitic Structure

Of particular interest at the third gray iron session, held Thursday morning under the chairmanship of V. A. Crosby, Climax Molybdenum Co., Detroit, was a paper describing the use of microradiography in studying the graphitic structure of gray iron. This paper was prepared by E. I. Salkovitz, J. H. Schaum and F. W. Von Batchelder, Naval Research Laboratory, Washington. Radiographical aspects of the subject were presented by Mr. Von Batchelder and the metallurgical features by Mr. Schaum.

In the process, x-rays are directed through a thin specimen onto a fine grained sensitive film which is then developed and examined under a microscope. The advantage of microradiography over metallography in the study of metals is that it reveals the depth of microconstituents through variations in density. For instance, graphite in gray iron is shown to be wider, longer and more uniform in shape than is indicated by metallographic examination. AFA type D and E graphite lie between the arms of the dendrites and serve to outline the individual dendrites when observed by microradiography.

"Graphite Phase in Gray Cast Iron," a paper presented by Robert W. Lindsay, Pennsylvania State College, State College, Pa., reviewed extensively the main features influencing formation of graphite—cooling rate of the casting, and carbon and silicon contents. It was also pointed out that the presence and structural features of graphite in gray cast iron are reflected in various physical properties of the casting, and since total carbon content regulates to a large degree the amount of graphite present, it is the job of the foundry supervisor to see that this amount of graphite is maintained in a wholly pearlitic

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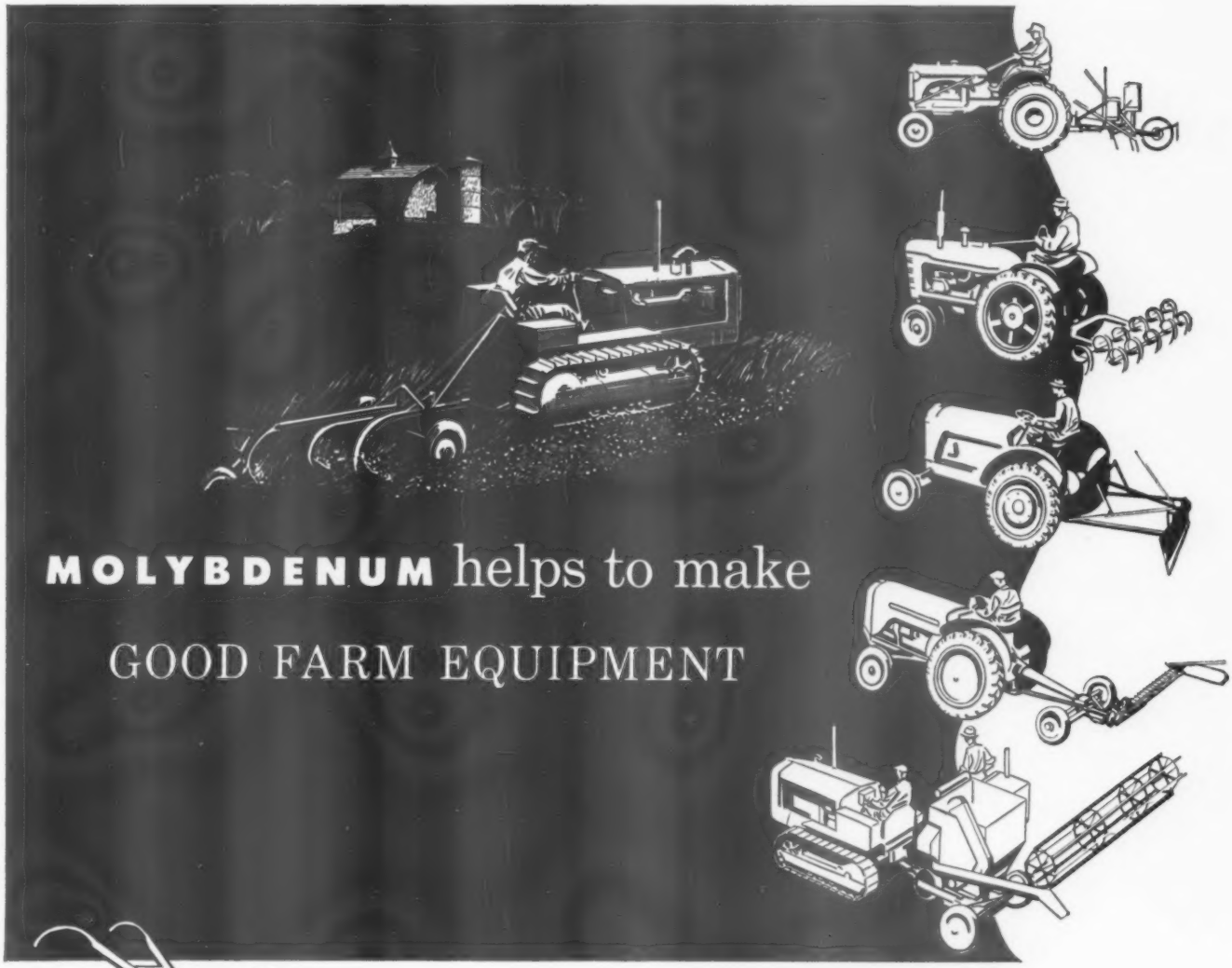

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MCA

(*Continued from page* 132)
matrix in most cases—or at least a close approach to the same, and to guide the formation of this graphite as much as possible toward type A distribution. The size and section relationships of the casting being fixed, the desired regulation is obtained by control of melting conditions and temperature, pouring temperature, alloying and inoculation practices.

Third paper given at this session, "Microstructure of Silvery Pig Iron," by Richard Schneidewind, University of Michigan, and Carl Harmon, Hanna Furnace Corp., Buffalo, was presented by the former. The authors' study shows that the graphite of silvery pig iron exists in long coarse flakes which represent the hypereutectic carbon and in small flakes which represent the eutectic carbon. The matrix consists solely of alpha silico-ferrite. Grain shape varies from area to area, and the crystals are either equiaxed or elongated. Inclusions are not numerous.

H. Bornstein, Deere & Co., Moline, Ill., was chairman of the concluding gray iron session, Thursday afternoon, at which three papers were presented. K. E. Rose, co-author with C. H. Lorig—both of Battelle Memorial Institute, Columbus, Co.—of a paper on "Effects on Gray Iron of Minor Constitutents Derived from the Additions of Copper Alloys" gave the discussion, which covered a study of the search for an economical form of copper to be used as an addition to gray iron. Studies were made of the effect of various elements on physical properties of gray iron when the copper addition was made in the form of an alloy, the constitutents including arsenic, antimony, lead, tin, zinc, aluminum, beryllium, bismuth, cadmium and tellurium. Mixed effects on properties were observed from these various additions. Aluminum showed no significant variations; lead caused a decline in most properties; zinc's effects were not particularly adverse, while bismuth had a generally harmful influence.

"Isothermal Transformation of Molybdenum Cast Iron," a paper by C. A. Nagler, Wayne University, Detroit, and R. L. Dowdell, University of Minnesota, Minneapolis, was presented by the former. Transformation curves and micrographs of specimens were shown. Treatment included a solution temperature of 1600 F followed by a salt bath quench at 1000 F.

The concluding paper, describing "Reduction in Chilling Tendency Through Silicon Carbide Inoculation of Gray Cast Iron," was prepared by E. A. Loria and A. P. Thompson, Mellon Institute, Pittsburgh, and H. D. Shepard, Kerchner, Marshall & Co., Pittsburgh, and presented by Mr. Loria. Although referred to as inoculation, the treatment consists of silicon carbide additions in the form of briquets which are added in the cupola. The addition is said to produce a substantial increase in tensile strength with no increase in hardness, an increase in transverse strength and deflection, and a decrease in chill test hardness. It also promotes better distribution of graphite in a matrix of fine pearlite.

VARIOUS SAND PROBLEMS

Considered in Shop Course

FIRST session of the Sand Shop Course, sponsored by the Sand Shop Operation Course Committee, was held Monday evening. Presiding chairman of the group, which numbered about 150, was D. F. Sawtelle, Malleable Iron Fittings Co., Branford, Conn., assisted by E. C. Zirzow, National Malleable & Steel Castings Co., Cleveland.

David Tamor, American Chain & Cable Co. Inc., York, Pa., acted as discussion leader in the consideration of "Malleable Sand Problems," and described sand practice in mechanized foundries. Mr. Tamor pointed out that the sense of feel developed by craftsmen in old-time foundries to determine proper consistency of sand for foundry use is not sufficiently accurate for modern times. Proper qualities of grain size, refractoriness, bond, permeability and durability, must be definitely determined.

Mr. Tamor discussed comparative values of natural bonded and synthetic sands, explaining geographical differences in content of sands from different parts of the country and stressed the importance of adequate equipment for sand handling. A common mistake, he said, is to have sand hoppers that are too small. If a 150-ton hopper is indicated, a 300-ton hopper will serve better, as the sand will remain cool and more suitable for use.

In the discussion period which followed the talk, Mr. Tamor was asked about the use of gray iron molding sand for bronze castings. The speaker said he had used it but that this sand should be rammed harder than normal and pouring temperature watched carefully.

E. J. Bush, Washington Navy Yard, and E. W. Horlebein, Gibson & Kirk Co., Baltimore, presided as chairman and co-chairman, respectively, at the second Sand Shop Course, Tuesday evening, where W. M. Ball, Jr., Magnus Brass Division, National Lead Co., Cincinnati, led the discussion. Mr. Ball deplored the fact that although the Omnipotent Creator had scattered sand deposits all over the country, He had not laid down a single deposit that would serve all purposes and that would be accepted favorably by all foundrymen. Based on this premise he developed his theme under several heads, all leading to the same conclusion—that any sand must be manipulated and treated with the addition of one or more outside materials to realize its full potentialties.

Following the remarks of several speakers on the problems involved in the addition of bentonite, a quiet speaker who did not even stand up claimed he had developed a simple and efficacious procedure. His molds are wet down just after they have been filled with metal. Once a week a definite amount of bentonite is deposited on the cope. Then the molds are shaken out through a screen. He stated this treatment kept his sand up in a perfectly satisfactory manner. Replying to a question he stated that he was making red brass sanitary ware castings in which the metal was poured at temperatures varying from 1900 to 2150 F. Commenting on the foregoing statement, a member suggested that the steaming effect might be the factor which facilitated the satisfactory union of the sand and binder.

Discuss Effect of Ramming

Third Sand Shop Course was held Wednesday evening with R. H. Jacoby, Key Co., East St. Louis, Ill., and S. W. Brinson, Norfolk Naval Shipyard, Portsmouth, Va., presiding. Discussion leader was J. B. Caine, Sawbrook Steel Castings Co., Lockland O., and the subject "Role of Sand in Hot Tearing." First point discussed was effect of ramming. One member said he found it made no difference in sands with permeabilities ranging from 30 to 100 while another stated that at permeabilities of 25 to 30 soft ramming was necessary to prevent cracks, but at 75 permeability harder ramming could be used.

Another member said that he had eliminated hot cracking due to a core by using a high cereal content and only pressing the sand in the box without ramming. In that connection it was mentioned that high cereal with low moisture in a core operates satisfactorily except that such cores can not be used where the molten metal would impinge directly. A number of those present pointed out that excellent results were obtained by incorporation of wood flour in the sand for elimination of hot tearing.

Fourth and concluding session of the sand shop course was held Thursday

(*Concluded on page* 136)

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If your shakeout isn't full-floating, every time you shake a flask—you shake your foundry. The force of your vibrating mechanism has to go somewhere. When part of that force goes into the building structure, you're wasting power. You're adding unnecessary headaches.

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2. Reduce Labor
3. Help Sand Recovery
4. Cool Hot Sand
5. Minimize Flask Breakage
6. Improve Working Conditions

(*Concluded from page* 134)
afternoon. Co-chairmen of the meeting were B. L. Thomas, Cadillac Motor Car Division, Detroit, and F. R. Mason, Riley Stoker Co., Detroit. Topic for discussion was "Variables in Gray Iron Sand Practice," and the leader C. B. Schofield, Chevrolet Gray Iron Foundry, Saginaw, Mich. He described the general procedure of sand control as practiced in his foundry, and pointed out that in general sand control is set up on standard molding procedure, equipment, melting and pouring practice. When any of these are changed it may be necessary to review the sand conditions, and make corrections which will provide satisfactory castings.

USE OF TIME STUDY DATA

Discussed at Two Sessions

THURSDAY morning a group of approximately 100 attended the first session sponsored by the Job Evaluation and Time Study Committee. R. J. Fisher, the Falk Corp., Milwaukee, presided, assisted by J. A. Westover, Westover Engineers, Milwaukee, co-chairman. Mr. Fisher pointed out that the purpose of the group meeting was for the presentation of fundamentals which experience has shown to be necessary for taking good time studies, for the correct interpretation of time study data and for consistent and logical application in setting incentives.

"Establishment and Use of Standard Data," was discussed by M. Annich, American Brake Shoe Co., Mahway, N. J., who was assisted in the pace rating time study techniques by Harry Nickel of that company. Mr. Annich explained that pace rating or leveling is an attempt on the part of the time study observed to measure effort and performance of workers so that all observations can be reduced to terms of normal, or standard work time. Leveling is a fundamental step in setting up consistent incentives. To accomplish this it is necessary to establish and maintain certain standards of performance for elementary movements of the body which are considered normal or standard. These are termed bench marks of performance. By repeated observations of these clocked movements, the time study observer learns to judge first, a normal pace, and then to what degree or percentage any faster or slower movement varies from the normal.

Fatigue allowances, causes of erratic and inconsistent incentives in the past, were discussed. Some jobs are more fatiguing than others and in any one job some elements require a higher amount of exertion while others have little or none. The operator who shovels sand from a heap needs a much higher fatique allowance than one who uses a sand-slinger or has the sand delivered by an overhead conveyor. The proper method of applying fatigue allowances is not on an overall basis but rather by adapting it to the various types of movement involved and varying it with the force exerted or the weight handled by the operator. The time study breaks each job down into its elements and since the standard data from which the formula is derived is built up in a like manner, it is not difficult to apply fatigue factors in this way.

A table of fatigue factors was supplied the group, to be used as a guide in making elemental allowances in the standard data. Parts of the body used and types of movement were contained in the table, with force exerted or weight handled in pounds. From this time study sheet and a comparison sheet, formulas are derived for setting standards.

During the afternoon job evaluation and time study session Mr. Annich continued his discussion, describing the method used to set up the standard formula for computing a normal time allowance for doing a job. To arrive at this formula a comparison sheet is set up by entering normal times for various operational phases of a job. Normal times vary for different sizes and weights of equipment handled in performing similar jobs, thus the necessity for comparing times for similar phases of a job.

Two Classes of Elements Involved

In setting up this standard data two classes of elements are involved—regular and extra elements. Regular elements are those that occur in each cycle of the operation, and extra elements are those that occur in varying amounts (such as the number of cores to be set, etc.) or may not occur at all in some phases of the operation.

From the comparison sheet the formula for normal time allowance for doing a job is computed. To this must be added time allowances for the personal needs of the worker, fatigue and delay. The formula value for normal time is multiplied by this extra allowance to get the formula for standard time allowance for doing a job.

Mr. Annich pointed out that there are no hard and fast rules for developing standard formulas, and that he has attempted only to try to indicate possible methods by which the problem might be attacked. Imagination and ingenuity are prime requisites for analyzing the time study data and arriving at the best answers.

The discussion period brought out the fact that standards must not be altered to accommodate workers but that the pay rate should be changed instead as a compromise to any argument of unfair job-time allowance.

Refractories

THE single session sponsored by the Refractories Committee attracted an audience in excess of the meeting room's seating and standing capacity. Richard H. Stone, Vesuvius Crucible Co., Pittsburgh, and Arthur Klopf, Western Foundry Co., Chicago, were chairmen, and the program consisted of one prepared paper and a question and answer period.

"Special Refractories for Metal Melting," a paper presented by William H. Henson, Refractories Division, Norton Co., Worcester, Mass., first discussed the various classifications of refractories, the more usual types of failures, their symptoms and some possible causes. Special refractories were described as those refractories whose basic raw materials have been synthesized or fused in electric furnaces. They include that group whose chief constituent is one of the following electric furnace products: Fused alumina, silicon carbide, fused magnesia, and synthetic mullite. These are the best known and more common ones.

Silicon carbide is probably the most widely used special refractory material in the foundry field, being employed for lining and covers of crucible and non-crucible melting furnaces, air furnace combustion zones, crucibles, annealing furnace muffles, and cupola slag hole blocks.

Mr. Klopf acted as chairman of the question and answer period at which previously submitted questions relating to refractories and their applications were discussed.

Activity Suspended By Maehler Company

The Paul Maehler Co., Chicago, manufacturer of industrial ovens and furnaces, has temporarily suspended operations as of June 30 for the balance of the summer, meanwhile disposing of surplus equipment and materials, according to an announcement by A. E. Maehler, president. It was stated that the company requires larger and improved quarters, and that present difficulties in material supplies are preventing the company from maintaining its past standards. Mr. Maehler's illness also was given as a factor responsible for the suspension.

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These portables Give extra service and Take the punishment of this type of grinding

There is an important "give and take" to Sterling Vitrified and Resinoid Portable Grinding Wheels. They give many extra hours of grinding, and take less out of the workman while doing it!

Available in a wide variety of shapes and sizes, these "Wheels of Industry" grind welds, quickly remove gates and risers from castings, and do a better than usual job on all types of steel and castiron. Sterling's two popular specifications—KA146 P6 BPC for steel and C146 P7 BFC for castiron—are available from stock to solve your production problems, speedily and thoroughly!

For an easy-handling, cooler-running wheel, you cannot do better than specify STERLING every time! Our engineers will gladly cooperate!

Literature, describing these wheels and listing various specifications and applications, will be sent upon request.

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THE WHEELS OF INDUSTRY

THE NONFERROUS FOUNDRY INDUSTRY

(*Continued from page* 88)

foundries specializing in brass castings are comparable in size to large companies of other industries. The principal exceptions to this statement are found among the companies which make railway journal bearings and ship propellers. The largest sellers of other types of brass castings include many companies also active in the light metals field, those which are called here "mixed metal foundries."

Among companies specializing in aluminum castings, on the other hand, large companies are not uncommon. When aluminum was introduced in this country at the turn of the century, it was found that different methods of working this metal were required from those used with the older, heavier metals. To develop fabricating techniques and to further the use of the new metal, the Aluminum Co. of America, producer of the primary metal, entered into the making of castings and other intermediate products. This company still occupies a top position in the aluminum castings field, but does not control it. In fact, since the techniques for casting aluminum are now well established and understood, most brass foundries produce some aluminum castings of simpler types in normal times, and a considerable number of small companies specialize in the metal.

Large Companies Have Advantage

In the aluminum castings field, however, to a degree not true in brass, competitive advantages have gone to those companies which operate on a scale large enough to support a considerable investment in equipment, skilled labor and trained technical staff. Sales of aluminum castings are heavily concentrated in the hands of a group of large foundries which specialize in the metal. On the average, these companies are considerably bigger than the biggest brass foundries (exclusive of specialized brass foundries).

Several reasons may be cited for the prominence of large companies in the aluminum castings field. This part of the nonferrous foundry industry has developed in modern times and has made full use of the scientific methods of the age. The frequent demand for castings of complex design and exacting specifications has made this something of a necessity. Furthermore, to win markets for aluminum castings against the competition of older, less expensive metals, over and beyond the markets which the lesser weight of aluminum alone secures, it has been necessary to create in aluminum some of the superior mechanical properties of the heavier metals. This has been done in part through scientific alloying and precise technical controls, in part through a process of heat-treating. The expense of heat-treating equipment has in itself restricted the number of companies entering this part of the field.

In addition, aluminum foundries are not confined to short-run jobbing orders to the extent that brass foundries are and thus have greater chance of attaining high levels of output. Where brass castings are to be used in volume, consumers usually find it to their advantage to operate their own foundries. An interesting exception to this is found in the railroad castings field, where toll arrangements are worked out in contracts between buyer and seller to their mutual advantage. Users of aluminum castings, however, cannot so easily undertake to fill their own needs, due to the greater technical problems involved, and so more commonly depend upon commercial foundries. A further factor is that aluminum is peculiarly adaptable to permanent mold casting, an efficient method of large-scale production. Foundries equipped to do this type of work have been able to expand their markets into fields otherwise restricted to such quantity production methods as die-casting, forging and stamping.

In the magnesium field, somewhat as in the case of aluminum, two early producers of the primary metal have been the leading producers of fabricated products, principally castings. These companies and their competitors more closely resemble aluminum foundries than brass foundries in the scale of their operations. Serious technical problems are involved in handling this metal and skilled workmen, expensive equipment and trained engineering and research assistants are needed. This is the newest segment of the industry, of limited importance until the recent war period. It remains for techniques to be simplified and broader markets built before there can be many opportunities in this field for any but large producers. Even then, the factors which have favored large companies in the aluminum field will presumably also favor big producers here.

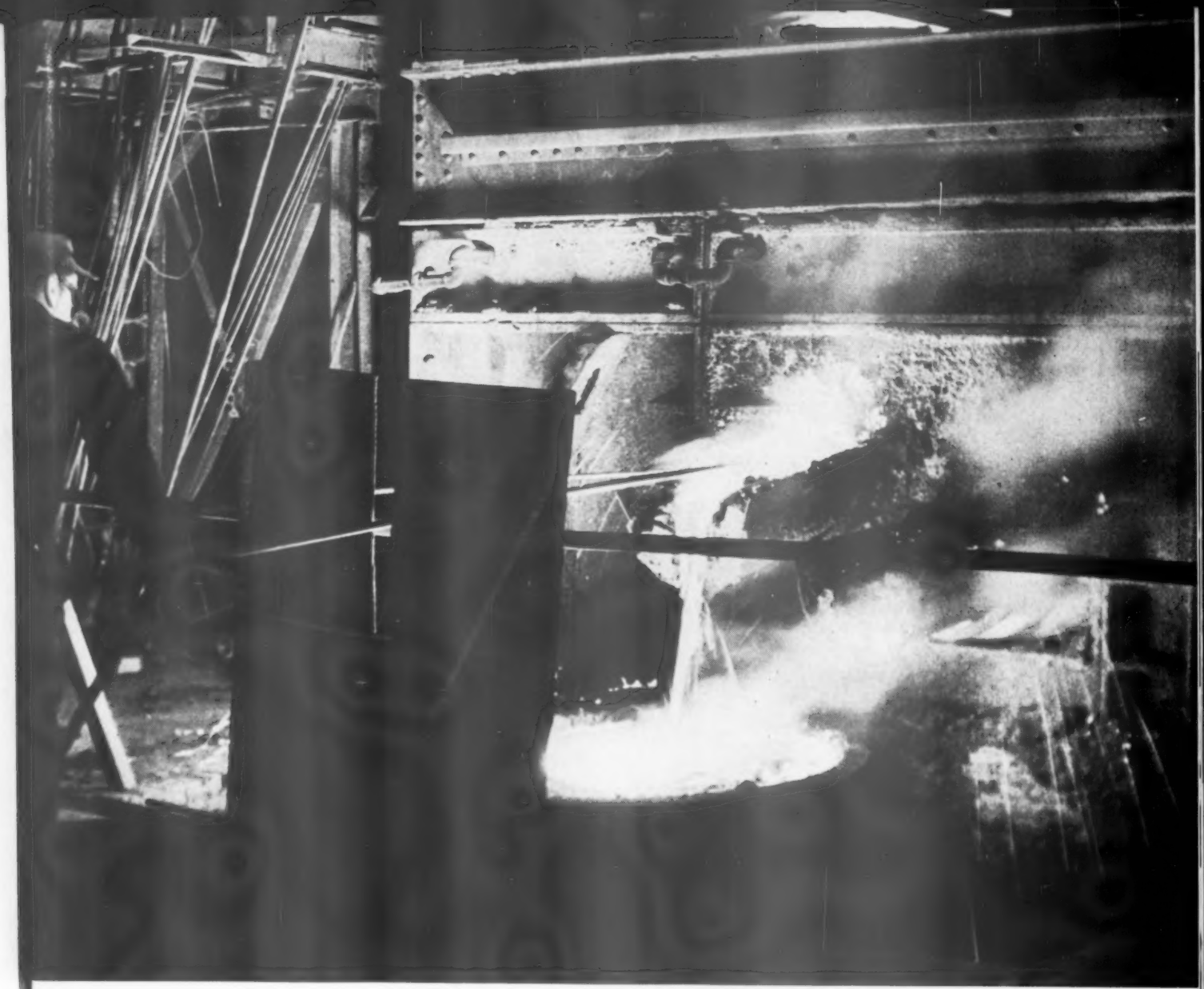
Multiple-Line Sellers—In all segments of the industry there is a large proportion of sellers who are not exclusively or primarily in this business. Many regular sellers of rough nonferrous castings also manufacture and sell other products in significant volume, usually products of a related nature, such as gray iron castings, machined castings, or assemblies. In addition, many companies whose foundry production is largely captive make occasional sales to outside customers as an accommodation or as a means of maintaining foundry operations at capacity. The majority of these multiple-line sellers are not too important in the industry, selling less than $50,000 of rough nonferrous castings a year. It happens also, however, that multiple-line sellers outnumber single-line sellers among the largest units in the industry.

Table II and Fig. 2 compare the distribution by size of foundry (or dollar volume of sales of rough nonferrous castings) of single-line and multiple-line sellers in the brass and mixed metal field and in the light metals field during the first half of 1942. It will be seen that among single-line sellers companies of the smallest size group (those selling less than $25,000 in the first half of 1942, or less than $50,000 on an annual basis) were equally numerous, proportionately, in the two fields, but that only 3 per cent of brass and mixed metal foundries were in the largest size group (selling $1,000,000 or more on an annual basis) as compared to 9 per cent of the light metal foundries. Among multiple-line sellers, those in the smallest size group are in the majority in both fields, but sellers of the largest size group are 12 per cent of the total number in the light metals field as compared to 2 per cent in the brass and mixed metal field.

Concentration of Sales — Companies selling less than $50,000 of rough nonferrous castings on an annual basis, a group representing more than half of all sellers, accounted for only 3 per cent of the industry's sales in the first half of 1942. This is substantially the group of companies exempted from the pricing provisions of Revised Maximum Price Regulation No. 125 when issued in February, 1943. At the other extreme, companies selling $1,000,000 or more of these products on an annual basis, a group comprising 4 per cent of the total number of companies, handled two-thirds of total dollar sales. As shown in Table III, the concentration of sales found in the light metals field is far greater than in the brass and mixed metal field. This is explained not only by the greater proportion of large companies in the former field, but also by the fact that the largest sellers of aluminum and magnesium castings in this period were, on the average, almost three times the size of the largest brass and mixed metal foundries.

Exemption of the least important sellers from the pricing provisions of Revised Maximum Price Regulation No. 125 left under control a group of foundries that were still predominantly small and medium-sized units, as will be seen in Table IV. Even in terms of total operations, they were mostly small companies, almost one-half of them having less than $250,000 in sales of all products in 1943

(*Concluded on page* 140)



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GRADE "A" *(Open Hearth)*	Vanadium . . . 35-40% Silicon . . . . max. 12% Carbon . . max. 3.50%
GRADE "B" *(Crucible)*	Vanadium . . . 35-45% Silicon . . . max. 3.50% Carbon . . max. 0.50%
GRADE "C" *(Primos)*	Vanadium . . . 35-45% Silicon . . . max. 1.25% Carbon . . max. 0.20%
HIGH V GRADES	Vanadium . . . 50-55% 60-65% 70-80% Silicon . . . . . Low Carbon . . . . . Low

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(*Concluded from page* 138)

(see Table V). Price policies had to be fitted primarily to the conditions affecting these companies, since they were the most numerous type in the industry and far from unessential to the war effort.

Geographical Distribution—Nonferrous foundries are located close to the industries which use their products. Particularly is this true in the brass castings field, where there are seldom shipments of castings to distant points. This means that the industry is heavily concentrated in the industrial areas of the East and Middle West (see Table VI). The Central States—Ohio, Michigan, Indiana, Illinois, Wisconsin, Minnesota, Iowa and Missouri—had, in 1943, 37 per cent of the total number of commercial foundries and 56 per cent of the industry's dollar sales. This area was the most important one in all metal fields, aluminum and magnesium as well as brass. New Jersey, New York and Pennsylvania had about 25 per cent of the number of companies and almost the same proportion of sales, while New England had about 10 per cent of both number and sales. The Far West was a fourth important foundry region, being especially active in the light metals field.

Effect of Wartime Conditions—Structure of the nonferrous foundry industry is not a constant thing. The industry has several characteristics which permit it to adjust readily to changes in operating conditions. Among these are the facts that (1) little equipment and little capital are tied up in the operations of the average foundry, so that it is a relatively simple matter to go in or out of business or to suspend operations temporarily; (2) many foundries are prepared to work extensively with either brass or aluminum and thus can adapt their production to changing requirements; (3) captive foundries constitute a reserve capacity which may be drawn into the commercial field in periods of tight demand; and (4) the average foundry can greatly increase its output without increasing its physical capacity, particularly when production runs are longer and castings heavier than usual.

During the recent war period, restrictions on materials, shortages of labor and shifts in production to exacting war work caused the closing, temporary or otherwise, of many units. Also multiple-line sellers frequently withdrew from the commercial field, as their own casting requirements absorbed the full output of their foundries. There was a net loss in the number of active commercial foundries, despite the appearance of many new units. From 1941, the period covered by OPA's earliest count of active sellers, to 1944 the number of commercial nonferrous foundries dropped from more than 1500 to roughly 1350. The companies which suspended operations were most commonly small brass foundries. The new sellers were principally in the light metals field. While the number of companies declined, the volume of production increased many times, due as much to increased output of existing facilities as to the addition of new capacity.

A distorted picture of the industry's normal distribution by metal specialty classes is given in Fig. 1, which is based upon conditions in the first half of 1942. The chief peculiarity lies in the importance of aluminum and magnesium foundries. Both the number of companies and the volume of sales of the light metals segment were abnormally high in this period. The number of commercial foundries actually handling the light metals decreased under the priority controls of the war, but the number of companies specializing in them increased. New plants were opened, both government-financed and private, and existing foundries which had been previously captive or which had worked wholly or partly in brass entered the field. Immediately following the war's end, many of these wartime sellers withdrew.

TABLE VII—Percentage Distribution by Class of Foundry of Dollar Sales of Rough Nonferrous Castings, 1941, 1942 and 1943

Class of Foundry*	Distribution of Dollar Sales 1941	1942	1943
Brass foundries:			
Specialized foundries: Makers of railway journal bearings or ship propellers	17%	13%	11%
Other brass foundries	36	29	24
Mixed metal foundries	11	12	12
Aluminum foundries	29	35	36
Magnesium foundries	7	11	17
All foundries	100	100	100

* Basis of classification is outlined in footnote 2 of Table I. Companies whose metal specialty changed over the war period are classified by their 1942 or 1943 specialty.

In 1942, 1943 and 1944, dollar sales of light metal castings exceeded sales of brass castings, whereas before the war the value of rough aluminum castings sold was considerably less than that of brass castings and sales of magnesium castings were negligible. Over the period 1940-44, brass foundries had a declining share of the industry's total sales, and aluminum and magnesium foundries had an increasing share, as is suggested by Table VII, which covers only the years 1941-43.

A distorted picture is also given of the industry's normal size distribution where the figures of a wartime period are used. When size of company is measured by sales (and for a comprehensive study of the industry this is the only practical measure), companies move rapidly from one size group to another once sales begin to expand or contract. This point is illustrated in Table VIII, which gives the distribution of foundries by dollar sales of rough nonferrous castings in 1941 and 1943. By 1941, individual foundry sales were already much expanded from peacetime levels so that even the distribution for this year overstates the percentage of large sellers normally found in the industry and understates the percentage of small sellers.

Sales Distribution Unaffected

Table VIII also distributes dollar sales of rough nonferrous castings by size of foundry in 1941 and 1943. It will be seen that the largest size group contributed a larger proportion of the industry's sales in 1943 than in 1941 but that this inevitably follows from the fact that a larger number of companies were in this group. There is no indication, in available evidence, of an increased concentration of sales in the hands of the largest foundries over the war period. The ratio of total sales handled by the industry's ten largest sellers advanced from 40 per cent in 1941 to 45 per cent in 1942. In 1943, however, when a number of large new aluminum and magnesium foundries came into production, the ratio was cut back to what it had been in 1941. The largest companies in the industry grew tremendously from 1940 on, but so did the small companies. Except in certain instances, wartime requirements for foundry products were not so specialized or difficult as to be beyond the ability of small producers. This fact and the fact that the new producers of the period were generally large suggest that little, if any, increase in concentration may have occurred. Without information for some year earlier than 1941, however, no satisfactory investigation of this matter can be made.

(*To be continued next month*)

TABLE VIII—Percentage Distribution by Size of Foundry of Nonferrous Foundries and Dollar Sales of Rough Nonferrous Castings, 1941 and 1943

Size of Foundry	Distribution of —Number of Companies— 1941	1943	Distribution of ——Dollar Sales—— 1941	1943
Annual sales of rough nonferrous castings:				
Less than $50,000	62%	50%	4%	2%
$ 50,000-$100,000	12	11	5	2
$100,000-$250,000	14	19	12	7
$250,000-$500,000	7	9	13	7
$500,000 and over	5	11	66	82
All size groups	100	100	100	100

Sources: For 1941, questionnaire and telephone survey of spring, 1942. For 1943, OPA Forms 677-668 and 677-669. Adjustments made for nonreporting foundries.

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STUDY BEHAVIOR OF MOLDING SAND WITH LIQUID STEEL

(*Continued from page 77*)

alternately immersed and withdrawn from the molten metal at a frequency of one immersion per second. This test simulates the conditions prevailing at mold surface as the metal first enters the mold, at the surface of gates, or at any location where the metal flow across the sand is discontinuous, as it is when metal is dropped some distance vertically, or near the gate on flat horizontal surfaces.

5. Continuous immersion for a short time (2 seconds) followed by alternate immersion. As will be shown later, there is a great difference in the behavior of a sand if a glaze is formed by contact with stationary metal and then the sand is subjected to moving metal. This test more closely approaches normal pouring conditions with proper gating and pouring practice. In this case a pool of metal is formed, the rest of the metal falling on and flowing from this pool, so that a glaze forms before the mold surface is subjected to the erosive action of flowing metal.

Metal Did Not Adhere

Contrary to expectations, no metal adhered to the immersed sand specimens if the metal temperature was over 2900 F. Steel did adhere to the specimen if the metal temperature was under 2900 F. At these lower temperatures the steel could not be poured from shank ladles. With metal temperatures just below 2900 F metal would adhere to the specimen for the first 5 seconds or so of immersion and then melt away.

Tests 1, 2 and 3 are self explanatory and the results from any given sand are quite consistent. The occurrence or disappearance of any defect can be checked on duplicate specimens to within a time interval of less than 5 seconds. (±2 seconds).

Consistent results with alternate immersions are more difficult to obtain because the violence of the immersion is a major variable in determining when spalling will occur. As this test is quite severe and is used to test the behavior of the sand under the most unfavorable conditions it would encounter in the foundry, the immersion was as violent as possible, the limit being just before the metal splashed into the observer's shirt or shoes when the specimen is held at arms length. This automatically and humanly imposes a top limit on the violence of the immersion. Danger of inconsistent results arises from not using enough violence and is strongest just after the top limit is exceeded, especially if the observer is frantically trying to keep a spark of metal from lingering too long on any one spot on his person. The establishment of these limits may seem quite unscientific but the reader can be assured that they can be established in practice. After some practice (and some charred epidermis) defects on alternate immersion can be duplicated to within a time interval of ten seconds (± five seconds).

The sand specimens were exposed to radiant heat and immersion from 2 to 40 seconds. Only in unusual cases were any defects encountered that formed after a period of 40 seconds. In fact, most occurred at a time interval of some 2 to 15 seconds. This fact is in itself quite enlightening.

Type of Defects Encountered—Fig. 2 shows a sand resistant to radiant heat (Test 1). The sand first chars, the char burning out at a time interval between 10 and 20 seconds leaving the sand surface white. No cracking, shelling or spalling occurred up to 120 second exposure, with this sand. When these specimens were then immersed in molten steel and withdrawn, the original shape was preserved and no spalling was experienced.

Fig. 3 shows a sand that cracked and shelled when exposed to radiant heat (Test 1). The cracked areas have shelled away from the body of the specimen and are separated by as much as 1/16-in. When such cracked and shelled specimens are immersed in molten steel (Test 2) the shelled area spalls off.

With other sands even more susceptible to spalling with radiant heat, the whole bottom surface will spall off to a depth of ⅛-in. when subjected only to radiant heat. This spalling can be very rapid, the end spalling off in 5 to 7 seconds.

The rapidity of glaze formation when molding sand comes in contact with molten steel is quite surprising and can be checked easily by Test 3. A sand with just enough bentonite added to a washed silica sand to make it moldable, will form a glaze in two seconds when in contact with molten steel at 2950 F. Such a sand when air-dried is so friable that it can hardly be handled. After 2 to 5 seconds immersion in molten steel the glaze formed cannot be scratched with a sharp point. The sand specimen itself will break if enough pressure is used to puncture the glaze. This condition prevails until the specimen cools below red heat. When the specimen cools to room temperature the sand in back of the glaze disintegrates, and the specimen as a whole can hardly be handled. The glaze, however, still has enough tenacity so that it can be handled with tweezers. With longer immersion time, a thicker glaze is formed, which on cooling can be stripped from the specimen to form a cup that will support its own weight.

The glaze can be examined under the microscope and the glazing action followed. Although attempts have been made to photograph this glaze, color photography is necessary to show the constituents. They do not register in black and white. A liquid constituent with an orange color in contrast with the white sand grains forms, at 2 to 5 seconds, the amount of the liquid constituents increasing as the time of immersion is increased. A maximum of 50 per cent of liquid constituents was found with immersion times up to 2 minutes, on all sands studied to date with the exception of unwashed cement bonded sand. With the exception of the cement sands no sands fuse completely within the time interval. In every case the larger original sand grains can still be seen, these grains simply being bonded together with a liquid phase. The iron oxide content of a number of these glazes has been determined. The increase in iron oxide content in every case studied so far has been low, less than 2 per cent. The Fe_3O_4 content decreases as the time of immersion increases. This phase of the investigation is still incomplete but it suggests that the high iron oxide content of some steel sands, obtained after the casting has cooled to room temperature, is due to the absorption of iron oxide by the sand after the metal has solidified.

Glaze Formation Studied

Fig. 4 shows this glaze formation on a sand that did not spall on immersion. The glaze is still spotty after 1 second immersion, becoming continuous between 1 and 5 seconds immersion.

The spalling and buckling behavior of sands on continuous immersion (test 3) is quite complex. Fig. 5 shows the behavior of a sand "just on the edge" and is typical of many sands. Note that no defects form after 1 second immersion. Definite buckles occur on the perifery of the specimen after 2 seconds immersion. Note their resemblance to scabs. All that is necessary is for the metal to flow behind the raised buckle and a typical steel foundry scab will be formed. It was quite surprising that the same sand specimen, held for 5 seconds and longer, showed no evidence of any discontinuity on the surface.

It might be argued at this point that the buckle formed at 2 seconds was pushed back into place by the hydrostatic pressure of the metal, or that the buckle formed as the sand specimen was removed from the steel.

(*Continued on page 146*)

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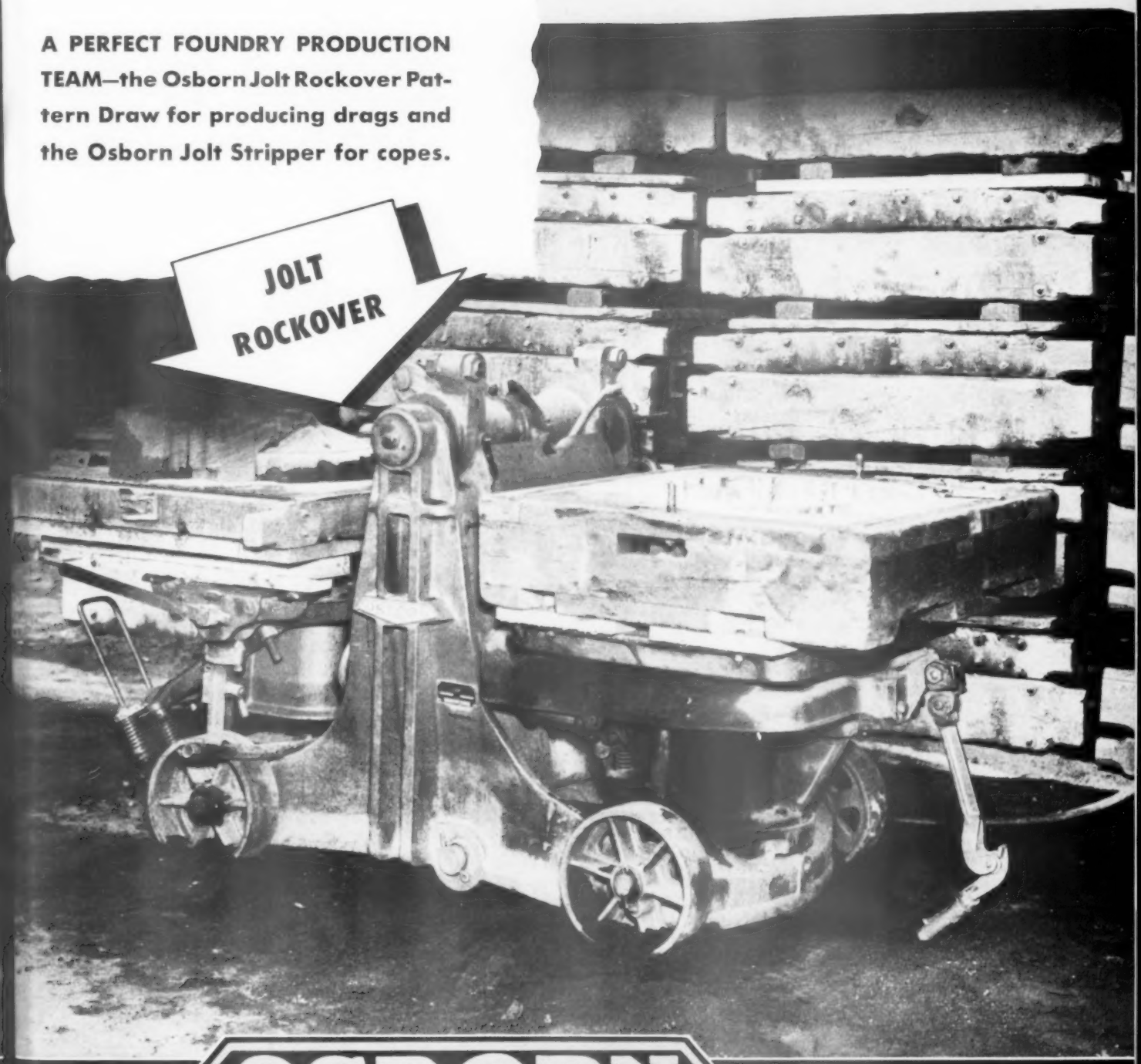

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(*Continued from page* 143)

Further work disproved these arguments. Fig. 6 shows a series of specimens immersed from 2 to 20 seconds. The 2-second specimen shows the typical buckle, the 5-second specimen a definite spall. The spalled area is disappearing on the specimen immersed for 10 seconds and no defects can be seen on the surface of the specimen immersed for 20 seconds (the dark area at the corner of the 20-second specimen is slag).

This behavior was experienced many times and almost invariably a piece of sand could be seen rising to the surface of the steel at the time when the specimen spalled. Nevertheless, if the specimen was left in the steel for another 5 or 10 seconds no trace of a spall could be seen. To check this point specimens were cracked when rammed, and it was found that cracks up to 1/16-in. wide would glaze over and disappear after 5 or 10 seconds continuous immersion.

Loose Sand In Cope Explained

This behavior may explain one cause of mysterious loose sand lodged in the cope that has plagued the foundry industry for years. A sand that buckles and spalls in say 2 to 5 seconds is spalling while the mold is being filled. These spalls would be broken off and carried along with the moving metal. As they are lighter than the steel they would float to the cope. Additional contact with stationary molten metal after the mold is filled would glaze over these spots and it would be impossible to find them. If these areas cannot be found on a small specimen when one knows where to look for them, how can they be found on a large casting when one does not know where to look?

No freak sands were used to make the previous defects. They were all produced on production sand by over-ramming to a hardness of over 90 in the green stage. This hardness level is not too uncommon in actual molds, especially on flat surfaces.

Figs. 7 and 8 illustrate an extreme; high water content, plus hard ramming, 6.1 per cent water, 20 rams. In this case the sand has not spalled just once, but twice. Note the thickness of the spalls and their viscosity. The glaze formed is so viscous and tenacious as to allow the spalled portion to bend 90° and still adhere to the specimen. Note also how the surface under the first spalled portion is beginning to glaze over in 20 seconds. Spalling during continuous immersion for as long a period as 20 seconds was not found except under extreme conditions. There was a violent gas evolution when these specimens were immersed and it is doubtful if the metal would stay in the mold if a mold was made of this sand. With normal sand any spalling is complete in 10 seconds or less, when in contact with stationary metal (continuous immersion).

Spalling during alternate immersion seems to occur in a different manner. Fig. 9 shows three types of spalling defects encountered with this test. Specimen *A* shows a type of defect that may be spalling or may be erosion. The corners fail very quickly, in less than 5 seconds, and no further spalling occurs. This type of defect would be a cause of loose sand in the cope, for the sand would be dislodged just after the metal contacts the mold surface. It would float away with the metal and the areas from which it was dislodged would glaze over and become invisible.

Specimen *B* shows another typical spall occurring on alternate immersion (moving metal). The corner and part of the bottom surface and perifery have spalled in one piece. This type of spalling usually occurs after the type illustrated by specimen *A*, and after 5 seconds alternate immersion. The spalled portion is quite thick, being about ⅛-in.

If the sand is susceptible to spalling with alternate immersion, the whole bottom surface spalls off to a depth of ⅛-in. down to uncharred sand, as shown by specimen *C*. This type of spalling usually occurs in 1 or 2 seconds after immersion and is quite common.

When the specimen is immersed for 2 seconds to form a glaze and then immersed alternately (Test 4), the sand will spall in the same manner as in Fig. 9. However the resistance to spalling of most sands is much greater with this test than when immersed alternately without allowing the sand to form a glaze. This point in itself is one check as to the correlation of the test to actual practice. For, witness, the care the steel foundry takes to gate so that the metal enters the mold quietly. Also witness the ladle man pouring a bottom pour ladle. He partially opens the stopper until a pool of metal forms, then opens it wide and lets the metal surge in. These men have learned from bitter experience that our sands will not withstand an immediate surge of molten steel. They say that a pool of metal must first form. These tests also point out that a glaze must first form. After the glaze has formed the sand will withstand considerable punishment.

Correlation of the Tests—The five tests described in the previous paragraphs are interesting in themselves, for they show visually the behavior of sand when in contact with liquid steel. More important, however, is a quantity correlation of the tests with the behavior of the sand in the mold itself. If a sand spalls or buckles in this test, can one be sure that it will do so in the mold, and what is more important, if a sand behaves satisfactorily in this test, can it be depended upon to behave satisfactorily in the mold and produce acceptable castings?

In an endeavor to check this point a number of sands were tested, sands whose behavior under certain conditions have been determined by actual experience in production. For example, it is almost universally accepted in the steel foundry industry that over-ramming will cause scabbing. Various sands were then rammed to various green hardnesses and tested. As will be shown, these tests do show an appreciable difference resulting from ramming and the tests follow closely experience in production.

Appreciable variations were also found owing to water content of the sand; whether the sand that forms the casting is green, or air dried; new vs reclaimed sand; cereal bonded vs straight bentonite sand, etc. In all cases variations in the tests follow closely those experienced in production.

Over 5000 Tests Made

Before going into the details of the test results, a word or two regarding the manner of presentation of results is considered advisable. Due to the number of tests, over 5000 individual tests have been made so far, tabular presentation is out of the question. Standard graphical presentation using charts or graphs is inapplicable for we have only one numerical variable, time. Therefore, it has been necessary to resort to what may be an unfamiliar type of presentation, using histograms. In the following discussion, each of the five tests is represented by a column (radiant heat, test 1, and radiant heat plus immersion, test 2, have been consolidated to one column).

The height of each column represents the time in seconds that sand will withstand that particular test. The maximum length of time for any test was 40 seconds since the scabbing type of defects occuring after 40 seconds are rare. However, in a great number of tests the column does not start at 0, or it will be broken at some intermediate time. This simply means that spalling, buckling, or shelling was found at that particular time. An example would be those sands depicted in Figs. 5 and 6. These sands buckled and spalled at 2, and from 2 to 10 seconds, respectively, and did not spall at longer times of immersion. Their histogram column for continuous immersion would then not start at 0, but at 2 seconds for the sand shown in Fig. 5, and at 20 seconds for the sand shown in Fig. 6.

In other words, any break in the histo-

(*Continued on page* 149)

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gram column signifies that the sand is not behaving satisfactorily at that particular time. How bad the sand is behaving can be judged not only by the width of the break, but also by its position. If the sand under test is to be used in a mold that will be filled in 5 seconds, one that spalls under radiant heat (cope spalls) in say 20 seconds would not be unacceptable for use in production. The same sand used for larger molds that require 40 seconds to fill would cause trouble.

A break in the histogram column at short time intervals would be dangerous, for any sand, no matter how well the sand behaves at longer time intervals. It would spall almost immediately when the metal enters the mold, causing at least loose sand, often with no visual evidence as to where the loose sand originated.

Effect of Ramming and Air Drying—The effect of ramming and whether the sand is tested green, within one-half hour after ramming, or allowed to air dry is so great that it was found necessary to test each sand at three levels of ramming, ½, 3 and 20 rams with the standard AFA rammer, and to test each sand both green and after air drying over night.

The behavior of three typical steel foundry sands in contact with liquid metal is shown in Fig. 17. Their room temperature properties are tabulated in Table I. The lower row of histograms in Fig. 17 are those of a straight bentonite bonded sand, 6.0 per cent western bentonite added to a washed silica sand. The behavior of this sand in this test may answer the perennial argument, bentonite vs cereal binders. Note that when this sand is subjected to molten steel while green and not rammed hard, it performs fairly satisfactorily. True, its resistance to alternate immersion is not too good, but its resistance is sufficient for lighter castings, especially those poured with shank pots rather than with large bottom pour ladles, when the pressure of the metal entering the mold is not too high.

On the other hand, straight bentonite bonded sands when air dried behave in such a manner as to make them almost valueless. As can be seen from Fig. 17, the air dried bentonite bonded sands spall in 10 seconds when exposed to radiant heat, and, if rammed hard (20 rams), not only spall immediately when subjected to moving metal (alternate immersion) but also spall during the first 5 seconds when in contact with stationary metal (20 rams, continuous immersion). It is concluded that the bentonite bonded sands show decreasing resistance to the metal as the ramming level is increased. This is especially true of the green sand.

The second row of histograms represents the behavior of a facing sand containing cereal and organic additions. This sand makes fairly acceptable castings up to about 3000 lb when used green or air dried (green sand practice). The sand does not scab or cope spall, but does give trouble with loose sand in the cope. The tests indicate that this sand is quite sensitive to ramming, as both the ½ and 20 rammed samples, whether green or air dried, show an inferior behavior than the sample of average green hardness, rammed three times.

The behavior of the air-dried sand rammed three times is quite interesting. Many sands containing cereal additions show this behavior on alternate immersion. The sand spalled slightly at 3 seconds. No further spalling was observed on alternate immersion until 12 seconds was reached. This slight spalling just after moving metal contacts the mold surface may explain the mysterious loose and scattered sand in the cope, a condition that was encountered in production with this sand.

Hand Ramming Not Responsible

The almost immediate spalling of the facing sand with cereal and lignin additions when rammed hard (20 rams) and in contact with moving steel checks the almost universal belief in the steel foundry industry that hard ramming will cause spalling and scabbing. This test also advances the possibility that the same defects can be caused by soft ramming, especially when the sand is air dried. There have been indications from production that just such a behavior does exist, but they have never been proven. Perhaps the actual mechanics is different, in that soft rammed sand erodes, rather than spalls, but the end result is the same; sand in the casting where it should not be.

The top row of histograms represents the behavior of a sand using reclaimed sand as the base rather than new sand, as was used in the previous two sands. Again we have a correlation between the test and actual experience in production. Facing sands made from reclaimed sand have seldom behaved satisfactorily in the steel foundry for larger castings, requiring appreciable time to finish and core up the molds, in which time the sand has an opportunity to air dry. Such reclaimed sands have performed satisfactorily for smaller squeezer molds that are closed up immediately and poured soon after molding.

The reclaimed sand used in this report has not been washed or ignited, and the word "reclaimed" does not refer to such sands. It is simply shakeout sand that has been passed over a magnetic pulley, a vibrating screen and a series of cascades. Some, but by no means all, of the fines have been removed.

Note that the reclaimed sand, even though it carries a relatively large amount of cereal binder, spalls immediately under alternate immersion (moving metal) when air dried. The same sand when green will withstand alternate immersion for 10 to 20 seconds. This point is so important that it will be discussed in more detail later.

Note also the behavior of this sand when rammed at different levels; when air dried the average behavior is better the harder it is rammed. When green, slight spalling occurs within 5 seconds if the sand is rammed either too soft or too hard.

The great difference in the behavior of sand in contact with liquid steel resulting from ramming may also explain the lack of consistent results obtained in production with the same sand. The ramming level used, ½, 3 and 20 rams are far from extreme for the green hardness obtained at these ramming levels; 50 to 90 are no greater, in fact not as great as will be found from mold to mold, or for that matter in the same mold, unless greater than usual care is taken by the molder in ramming up the mold.

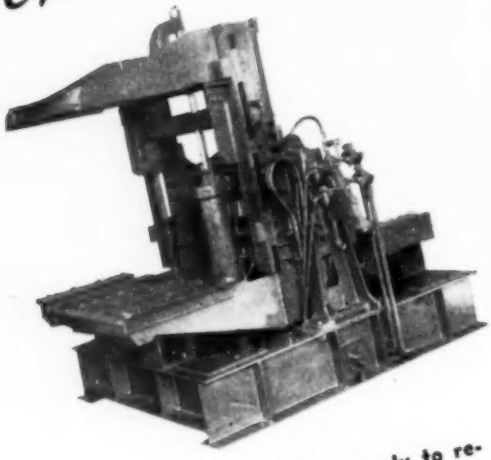
Another interesting point is that the room temperature properties shown in Table I give no indication of the difference in behavior of these sands when in contact with liquid steel.

Effect of Water Content—It is almost universally accepted in the steel industry that a water content in excess of that required to bring the sand to "temper" will cause scabbing or spalling. For the particular sands shown in Fig. 13, the optimum water content has been established as 3.0 to 3.5 per cent water. If the water content of these sands exceeded 3.5 per cent, scabbing has been encountered, but the correlation was not consistent. Production data indicated another variable but did not isolate this variable. Such a sand was tested at three different water contents by adding water to the base sand, a production sand, and remulling. The behavior of these sands in contact with liquid steel is shown in Fig 13. Their room temperature properties are tabulated in Table II.

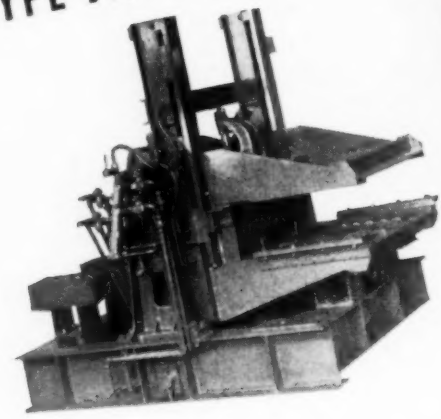
This was one of the first series tested, and was tested before the importance of soft ramming and the formation of the glaze was appreciated. Therefore there are no soft (½ ram) rammed specimens nor a histogram for 2 seconds continuous immersion, followed by alternate immersion. Nevertheless Fig. 13 shows that the test is capable of differentiating between 3.4 per cent and 4.0 per cent wa-

(*Continued on page* 153)

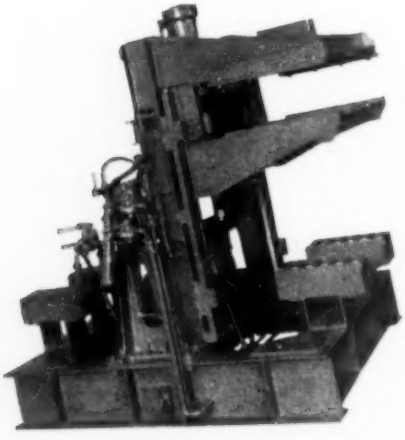
Cycle of INTERNATIONAL TYPE AN MACHINE



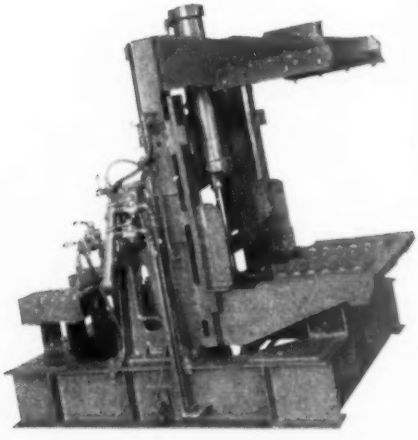
The machine is shown ready to receive the core box after it has been rammed.



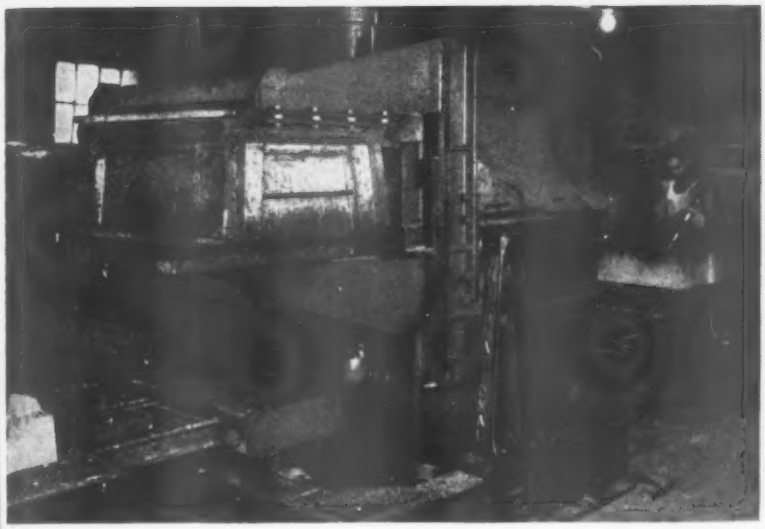
The draw frame has been moved into the position of clamping the core box and core plate.



Core box has been rolled over in the clamp position.



The core and core plate have been drawn from the core box.

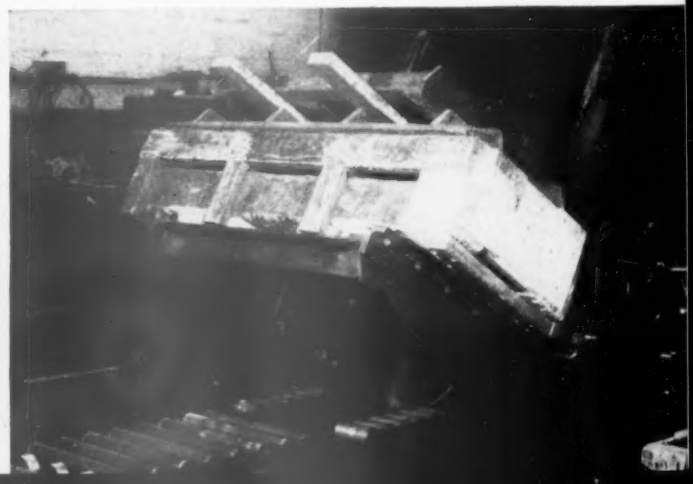


Hard to Draw . . . Short Run . . . Many Different Sizes of Boxes

INTERNATIONAL Type AN Machine for clamping and turning over core boxes and for drawing the core. No rigging time required. The core box is fastened to the turnover frame by sliding the cleats that have been fastened to the under side of the box into the grooves with which the turnover frame has been provided. Absolutely no adjustments are required. When boxes are changed from one size to another, irrespective of how much difference there is in the width, length and depth of boxes for which machine has been recommended, it automatically takes care of variations.

Has Air Clamp, Air Turnover, Air Draw Features. Flexibility and universal use has made the **Type AN Machine** popular. Easily adaptable to your molding problems. **Specify Internationals** and be certain of satisfaction.

INTERNATIONAL MOLDING MACHINE COMPANY • **La Grange Park, Illinois**



INSTALL BAKER PERKINS CONTINUOUS SAND MULLERS AT 50% LOWER COST

Industry is looking to wide-open production in the near future . . . and to foundry operators that means a resumption of the thorough beating that foundry equipment took during the war years. Right now is the time to replace your inefficient and worn-out equipment, and you can't make a better beginning than to install B-P Continuous Sand Mullers. These fast, dependable machines often may be installed for 50% the cost of installing other types of mullers, and their operation is far and away superior in ease and efficiency. Sand mixed in a B-P Continuous Muller is thoroughly aerated as it is stirred in a figure-8 motion, and each grain is coated with the correct proportion of bond. That means your sand molds will turn out smoother, finer finished castings . . . with dependable regularity, too, because the B-P Continuous Muller mixes sand to perfect consistency and uniformity with no batch to batch variation. No expensive hydraulic or electrical controls required, no batch hoppers or large storage bins necessary. Below: A No. 5-A B-P Continuous Muller, capacity 100 to 120 tons of perfectly mulled sand per hour. BAKER PERKINS INC., FOUNDRY EQUIPMENT SALES, SAGINAW, MICHIGAN.

MEMBER

MANUFACTURERS' ASSOCIATION INC. FOUNDRY EQUIPMENT

F. G. WADE INC.

EXCLUSIVE AGENTS FOR BAKER PERKINS FOUNDRY EQUIPMENT, CLEVELAND 3, OHIO

(*Continued from page* 149)

ter, in this particular sand. The test isolates the other variables that escaped detection in production and explains why every casting made with a sand with higher than optimum water did not scab and cope spall, for a combination of higher than optimum water plus hard ramming is required before a marked decrease in the resistance of this sand was noted.

It should be emphasized that the relation shown in Fig. 13 between water content and ramming applies only for this particular sand and this particular binder addition. The relation between water, binders and ramming is quite important and varies with each sand. Of course, when the water is increased very much, such as to 6.1 per cent, the sand is worthless as can be seen from the top row of histograms. The behavior of this sand in contact with liquid steel was illustrated in Fig. 6.

New Sand vs Reclaimed Sand—One of the most interesting problems for this new test, as well as one of the most potentially profitable from an economic standpoint, is a study of the reason why used sand seldom can be reclaimed and reused for facing sand in contact with liquid steel, especially for molds used to make larger castings.

Again, it is almost universally accepted in the steel foundry industry that reclaimed sand, at present at least, presents difficulties when used as a facing sand for larger castings. A number of steel foundries have been successful in the use of reclaimed sand for smaller castings, usually made on squeezer machines, but even these same foundries have been unable to use the same reclaimed sand for larger castings, for its use has resulted in very bad cases of scabs, cope spalls and loose sand.

Three sands were selected to illustrate this application of the test. All three sands have been used in production and were used during the late unlamented cereal binder shortage. The room temperature properties of these sands are tabulated in Table III, their behavior in contact with liquid steel is illustrated in Fig. 16.

The bottom row of histograms in Fig. 16 represents the behavior of the new sand facing from which the reclaimed sand originated. This sand has been used for years for both small and large castings and produced acceptable castings. The sand did not scab or spall if the water content was under control, the only defects attributed to the sand were occasional areas of loose sand in the cope on larger castings. The test shows that this sand will withstand molten steel fairly well, green or air dried except when under-rammed (½ rams) and tested dry. The slight spalling at 2 to 5 seconds of the air dried specimens under alternate immersion without a glaze formation probably explains the occasional loose sand found in larger castings made with this sand.

The middle row of histograms shows the behavior of the same sand after reclaiming and with an addition of 0.5 per cent bentonite to maintain the green strength and 0.5 per cent lignin pitch. This sand made acceptable small castings, under about 20 lb. Scabbing was encountered on larger castings poured green, especially those with flat surfaces, unless the molds were carefully rammed. The sand failed miserably on larger castings, made on the floor, that required appreciable time to finish and core up.

The tests follow the practical behavior nicely. Note that the sand is quite sensitive to ramming and has no resistance to alternate immersion if rammed soft or hard. If the sand is just slightly over-rammed (10 rams) it spalls under mild continuous immersion and the castings should show and subsequently did show scabs no matter how carefully they were gated and poured.

Compare Green and Air Dried Sand

The difference between the behavior of the sand tested green and after air drying is striking, for none of the air-dried specimens showed the slightest resistance to alternate immersion, and very little resistance to radiant heat. This behavior was experienced in production, for larger molds made from this sand scabbed and cope spalled so badly that it could not be used, no matter how it was handled.

The importance of air drying in the behavior of a steel molding sand has not been fully appreciated. Almost all of the molding sands applicable to so-called green sand practice tested to date have shown better behavior in contact with molten steel when green than when air dried. However, larger molds, especially those made with loose patterns are almost invariably air dried for pouring. Finishing and coring up will consume enough time to allow the surface to air dry. In many cases the mold is left open for additional hours until enough molds are collected to make a heat. If this is done, the sand is no longer green sand, but air dried sand.

Conversely, small molds made in production are invariably closed up immediately and, especially if blind risers are used, are almost sealed from the air and can remain closed up for several hours or over night before pouring without appreciable air drying occurring. Actually these are only molds made with green sand.

These tests indicate that all molds made with this type of sand should be closed and poured immediately. However, on large work, practical difficulties arise. Many larger molds made with loose patterns require extensive finishing. In hot weather it may become necessary to spray the mold surface with water in order to finish it. If this is done the water content of the sand in contact with steel is increased tremendously and the sand will behave like the sand with 6 per cent water shown in Fig. 13. The only recourse then is to allow the mold to dry and to use a sand that will behave satisfactorily when air dried.

The sand represented by the middle row of histograms in Fig. 11 was used in production making small castings for several months with satisfactory results. All of a sudden, even the smaller castings started scabbing and spalling. The results of this sand are shown by the top row of histograms in Fig. 16. Again the test checks production experience. The sand now spalls in contact with molten metal, with both continuous and alternate immersion, green or dry, no matter how it was rammed.

Perhaps the reason for this change was insufficient organic addition, perhaps it was hot sand (the change occurred at the onset of summer). However, regardless of the reason for the change, the test reported poor sand conditions.

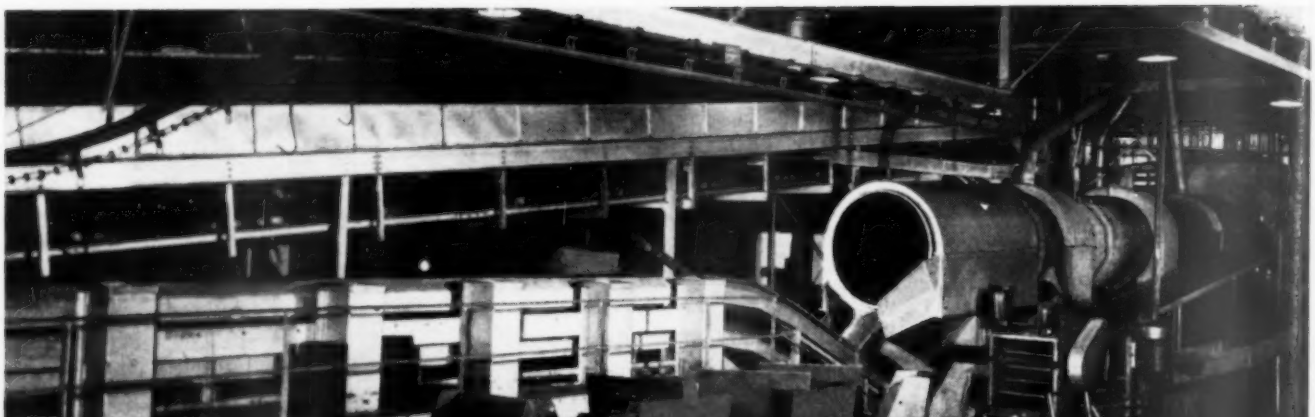
Summary, Part I—A test is advanced to study the behavior of molding sands in contact with molten metal. The test simulates more closely conditions existing in the mold when it is poured and therefore overcomes some of the objections that are fundamental to any correlation to room temperature or so-called high temperature testing and the behavior of the sand when it forms the casting.

The test is capable of differentiating between the behavior of sands that are known to be acceptable or unacceptable in production under the following conditions:

1. The effect of over-ramming has been studied. Sands spall in the test when over-rammed, a point that has been established in production. In addition, the possibility of under-ramming causing spalling or erosion is suggested by the test.

2. The test is shown to be capable of showing a difference in behavior of sand when the water content is increased 0.6 per cent. It also emphasizes interrelation between water content and ramming.

(*Continued on page* 155)



RANSOHOFF *AUTOMATIC CONTINUOUS STAR-RETURN* WET CLEANING MILLS

NO MANUAL HANDLING . . . FROM SHAKE-OUT TO INSPECTION IT'S AUTOMATIC EVERY STEP OF THE WAY

PRELIMINARY CLEANING AND DESPRUING MISCELLANEOUS CASTINGS. This 56-inch x 50-foot RANSOHOFF CLEANING MILL does a real job. From the cooling conveyor, work passes over a shake-out directly into the RANSOHOFF continuous wet automatic star-return mill. The work receives a seven-minute cleaning and at the discharge end the stars are separated *automatically* and returned by the conveyor to the charging end.

SAVE 30% TO 70%

Ransohoff Wet Cleaning Does Not Rust Castings

Designed, engineered and built to fit your production line to make cleaning continuous and automatic.

Equipped with sand conveyor tank, settling tank, patented RANSOHOFF PACKLESS CENTRIFUGAL PUMP and many other features originated by RANSOHOFF.

SEND US A SAMPLE BATCH. Our Research Laboratory will make tests and submit complete report without cost or obligation to you

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TOWNSHIP AND BIG 4 RR **CINCINNATI 16, OHIO**

(*Continued from page* 153)

3. The great difference in the behavior of a sand when green or air dried is shown by the test.

4. Perhaps the greatest difference shown by the test is the difference in behavior of a steel facing sand using new or reclaimed sand. The tests show a reclaimed sand to fail when air dried, whereas a sand with the same room temperature properties but made from new sand to perform satisfactorily in contact with molten steel when air dried. This checks production experience.

If these correlations are accepted as sufficient proof as to the validity of the test as a method of studying the behavior of sand in contact with molten metal, they should be very useful and efficient in the study of an important phase of foundry operations.

Part II—Effect of Some Organic Additions

The advantage of cereal or organic additions to a molding sand for steel has always been a debatable point. It has been argued in the past that such additions are not necessary. Nevertheless, their use is almost universal in the steel casting industry. The argument as to which cereal or organic addition is the best has been even more heated and less illuminating. As will be shown, one reason for the conflict of opinions is again green vs air dried sand, for the organic additions do not benefit the sand when green, nearly as much as when the sand is air dried. The tests indicate that a straight bentonite bonded sand can be used successfully in production if it is used in molds that are certain of being poured before air drying. Straight bentonite bonded sands are indicated as being worthless if the mold is poured after air drying.

Five organic additions were investigated. Four have been used in the steel foundry for years—corn flour, gelatinized corn flour, dextrin and lignin pitch. The other is new not only in its composition but in its application—a resin dissolved in a volatile solvent and sprayed on the sand after it is molded. It is similar to a number of such sprays that have been placed on the market recently.

The sands in this part of the paper differ from those in Part I, in that they were made in a laboratory muller, and not all of them have been used in production. However, enough has been used in production to again check the correlation between the results of this test and results in actual production.

Twenty-pound lots of these sands were mulled in a laboratory muller. Washed silica sand was used in all sands. The bentonite and organic additions were made dry to dry sand and mulled for an additional 3 minutes. When the specimens were sprayed with the resin binder, they were sprayed immediately after ramming, and air dried over night.

The same sequence of tests was used as in Part I. The specimens were tested green (within ½ hour after ramming) and after air drying over night. The sands were tested at three levels of ramming, ½, 3 and 20 rams. Each organic addition, except the spray, was tested at three concentrations, 0.5, 1.0 and 1.5 per cent added.

As bentonite must be added to all sands containing organic additions, it was first necessary to establish the behavior of these sands with bentonite alone. Three sands were tested containing 4.0, 6.0 and 8.0 per cent bentonite with a similar moisture content. The behavior of these sands in contact with molten steel is shown in Fig. 11; their room temperature properties are tabulated in Table IV.

As can be seen from Fig. 11, the behavior of steel facing sand improves as the bentonite content and green strength increase, especially if the sand is tested green, before air drying. The behavior in contact with liquid steel when air dried is not satisfactory, even if the 8.0 per cent bentonite is added and the green strength is at almost the limit of moldability, 10.3 psi green compression strength at three rams. The sands containing 6.0 and 8.0 per cent bentonite, without any organic additions, should however give good account for themselves when the molds are poured without air drying.

When an organic binder is sprayed on the surface of the sands, the bentonite sand seems acceptable for molds that are air dried before pouring, provided too much metal does not flow discontinuously over the sand. The action of these sprays is quite interesting. They seem to hold the sand together for the first few seconds until a glaze forms. Any spalling after the first few seconds is independent of the spray and depends on the composition of the sand itself. Such sprays seem to have their place as many molding sands are quite friable after air drying and during the first few seconds after coming in contact with liquid steel. These sprays do not seem to prevent spalling after an appreciable time interval.

As a 6.0 per cent bentonite addition to the washed silica sand results in about

TABLE V

Type of Sand	AFA Fineness No.	Additions	% Water	No. of Rams	No. of Grams =2"	Green Permeability	Green Strength Psi	Green Hardness	Deformation in./2"	Air Dried Strength Psi	Air Dried Hardness
Washed Silica	60	0.5% Corn Flour	3.5	3	158	130	8.2	81	.022	51	3
Washed Silica	60	0.5% Corn Flour	3.5	20	172	65	17.6	92	.024	93	33
Washed Silica	60	1.0% Corn Flour	3.3	3	156	140	8.5	80	.025	42	0
Washed Silica	60	1.0% Corn Flour	3.3	20	170	70	18.3	92	...	91	33
Washed Silica	60	1.5% Corn Flour	3.3	3	155	135	8.3	80	.026	42	0
Washed Silica	60	1.5% Corn Flour	3.3	20	170	68	18.1	92	...	87	30
Washed Silica	60	0.5% Partially Gelatinized Corn Flour	3.1	3	157	137	8.1	81	.021	57	5
Washed Silica	60	0.5% Partially Gelatinized Corn Flour	3.1	20	170	73	16.2	92	.020	105	30
Washed Silica	60	0.5% Partially Gelatinized Corn Flour	3.4	3	136	137	8.2	82	.021	42	0
Washed Silica	60	0.5% Partially Gelatinized Corn Flour	3.4	20	170	70	18.4	92	...	84	30
Washed Silica	60	0.5% Partially Gelatinized Corn Flour	3.1	3	156	135	8.3	80	.023	27	0
Washed Silica	60	0.5% Partially Gelatinized Corn Flour	3.1	20	170	70	18.1	92	...	63	20
Washed Silica	59	0.5% Dextrin	3.1	3	154	167	7.6	82	.026	51	3
Washed Silica	59	0.5% Dextrin	3.1	20	170	80	16.4	93	.027	125	45
Washed Silica	65	1.0% Dextrin	3.2	½	137	350	3.4	57	.045	48	0
Washed Silica	65	1.0% Dextrin	3.2	3	152	150	7.4	80	.041	105	27
Washed Silica	65	1.0% Dextrin	3.2	20	170	60	16.8	93	.032	190	65
Washed Silicon	65	1.5% Dextrin	3.1	½	135	350	3.6	57	.052	40	0
Washed Silicon	65	1.5% Dextrin	3.1	3	151	155	7.4	81	.040	90	25
Washed Silicon	65	1.5% Dextrin	3.1	20	169	65	16.8	93	.031	230	70
Washed Silicon	65	0.5% Lignin Pitch	3.6	3	156	170	8.3	82	.023	52	10
Washed Silicon	65	0.5% Lignin Pitch	3.6	20	170	83	17.2	93	.023	93	43
Washed Silicon	65	1.0% Lignin Pitch	3.1	½	138	325	3.6	57	.029	36	0
Washed Silicon	65	1.0% Lignin Pitch	3.1	3	155	130	9.0	83	.024	87	12
Washed Silicon	65	1.0% Lignin Pitch	3.1	20	172	50	18.3	94	...	171	55
Washed Silicon	65	1.5% Lignin Pitch	3.5	½	137	335	4.0	60	.034	42	0
Washed Silicon	65	1.5% Lignin Pitch	3.5	3	155	130	9.1	82	.028	93	25
Washed Silicon	65	1.5% Lignin Pitch	3.5	20	172	50	19.0	94	...	195	60

an average green strength of 7.6 psi at three rams, this bentonite addition was used in all the cereal or organic bonded sands that follow. The room temperature properties of all of these sands are tabulated in Table V.

Behavior of the sands containing 0.5 per cent of the four organic additions is shown in Fig. 12. As can be seen from Fig. 12, with the exception of corn flour, the 0.5 per cent addition has caused no appreciable change in the behavior of these sands when in contact with molten steel while green. The addition of 0.5 per cent corn flour has increased the resistance to alternate immersion appreciably when green, especially when the sand is rammed hard. When the sand is air dried, 0.5 per cent corn flour increased the sand's resistance to radiant heat and to continuous immersion when rammed hard. The same level of gelatinized corn flour shows little if any improvement over straight bentonite bonded sand, in fact this addition decreases the resistance to mild alternate immersion when rammed to an average hardness (3 rams).

Dextrin Addition Helpful

The addition of dextrin probably shows the most overall improvement, but this sand is not as resistant to over-ramming as those containing 0.5 per cent corn flour. Lignin pitch, if anything, decreases the overall resistance of the sand. None of these sands show any appreciable resistance to moving metal, alternate immersion, when air dried.

The beneficial effect of spraying with a volatile organic spray is quite marked when 0.5 per cent organic addition is present. These sands show little resistance to moving metal (alternate immersion) before spraying. After spraying their resistance is not bad. Lignin pitch is the exception. When sand containing 0.5 per cent of this material is sprayed, the average resistance is less than a sprayed sand containing only bentonite.

Fig. 14 illustrates the behavior of the sands containing 1.0 per cent of the various additions. Dextrin now starts to show an appreciable resistance to moving metal (alternate immersion) but is still sensitive to over-ramming. Corn flour shows the best resistance to over-ramming, although its resistance to moving metal (alternate immersion) is still practically nil.

Air dried sands containing 1.0 per cent dextrin show the peculiar gap in the histogram for alternate immersion. The corners of these specimens spall or erode at 3 to 5 seconds, with no further spalling occurring. This behavior is illustrated in Fig. 9A. Note the decreased resistance to alternate immersion of this sand when sprayed with the organic spray.

When the cereal addition is increased to 1.5 per cent, Fig. 15, sands containing corn flour and gelatinized corn flour show less resistance to molten steel than with a smaller addition of 1.0 per cent. The reason for this may not be the cereal addition itself, but due to the fact that all of these sands were made with a constant water content. The higher cereal contents may require a higher water content and the poorer behavior of these sands with high corn flour additions may be due to the fact that they simply contain too little water in relation to the cereal addition.

The resistance of the dextrin sand is improved with 1.5 per cent dextrin, but these sands are still sensitive to over-ramming when in contact with moving molten metal (alternate immersion).

A number of these sands have been used in production. The sand containing 1.5 per cent dextrin has been used at the writer's plant for years and produced acceptable castings up to 2000 lb in weight. As can be seen from Fig. 15 this sand sprayed or unsprayed does withstand molten steel fairly well. Its only weak spots are the slight spalling occurring on alternate immersion and its susceptability to over-ramming. Occasional trouble has been experienced that can be traced to these behaviors.

Causes Scabbing and Spalling

At the onset of the cereal binder shortage the summer of 1945, the dextrin content was reduced to 0.75 per cent in an endeavor to conserve on this material. The results were almost disastrous; scabbing and cope spalling were encountered. Although this exact condition was not investigated an interpolation between the histograms in Figs. 12 and 14 shows that this addition will spall with radiant heat at about 10 seconds when rammed hard and will spall when in contact with moving steel between 4 and 20 seconds, both failures occurring within the time interval of pouring the molds.

A lignin pitch addition of 1.5 per cent was then tried with even worse results and the histograms for this addition in Fig. 15 follows, for they show that these sands have practically no resistance to radiant heat or to moving metal, green or dry.

Sands containing the corn flours have proved successful for smaller molds, poured before they had an opportunity to air dry, but these sands eroded and spalled when used for larger molds that did air dry. These sands were tried before the organic sprays were introduced so no correlation can be made in this instance.

Following the indications of these tests a sand containing 0.75 per cent corn flour and 0.75 per cent lignin pitch was tried and made fairly acceptable castings. The corn flour of such a combination will resist over-ramming and spalling due to expansion. The lignin pitch will result in a fairly hard mold surface and resist erosion or spalling when in contact with moving metal. This sand did not spall but the surface was still fairly friable after air drying and trouble was encountered in the cleaning room with eroded sand lodge in the cope. Spraying the molds with the organic spray minimized this difficulty and acceptable castings were made for a period of months.

The behavior of this sand in the test is shown by the bottom row of histograms in Fig. 10. Note the gaps in the column for alternate immersion for the three-ram sample, and the low resistance to alternate immersion (moving metal) at ½ and 20 rams, as an explanation of the loose sand found in the castings made in unsprayed molds. Spraying the mold surface with the organic spray eliminated this discontinuous spalling or erosion in the tests and a definite improvement in casting quality was noted in the cleaning room.

Mix Dextrin With Lignin

The second row of histograms in Fig. 10 shows the trouble that can be encountered by blind extrapolation. Dextrin is known to be a good addition; why not mix it with lignin and make a better sand than that containing equal amounts of corn flour and lignin? Fortunately, the tests were a guide and only a few castings were made with this sand. Bad scabbing and cope spalling were encountered, sprayed or not sprayed. The histograms show the resistance of this sand to moving metal to be appreciably lower than the sand represented by the lower row of histograms, and this sand spalls when exposed to radiant heat if rammed hard after a time interval of 10 seconds. It is interesting that the cope spalled in the mold in 6 seconds.

Dextrin, lignin pitch and the new organic sprays are what might be called glues, whereas the corn flours possess very little adhesiveness but do impart a sort of fluffiness to the sand. It is possible that combinations of these two classes of organic additions will result in cheaper sands with better resistance to molten steel than can be gained by a single addition. This would consist of flours and similar materials to give fluffiness and resistance to over-ramming, especially flat horizontal surfaces, combined with a "glue" to hold the sand grains together until a glaze forms. However, the indiscriminate mixing of the various cereal and organic additions now on the market can actually lower the resistance of the sand to molten metal.

It should be possible at this time to draw some tentative conclusions as to the

(*Concluded on page 158*)

DSM SPECIAL MOTOR WASHING MACHINE

MODEL BD-1309

MOTOR CLEANING EQUIPMENT: *Washing machines for cleaning tear-downs. Kerosene spray or similar solvent usually used as the cleaning medium.*

A	Width (Working Clearance)	44″		
B	Height (Working Clearance)	24″		
C	Width Over All	65″		
D	Length Over All	26′8″		
E	Height Over All	8′0″		
G	Wash Pump Capacity, G.P.M.	450		
	Motor Speed R.P.M.	1750		
	Motor H.P.	15		
	Wash Tank Capacity, Gals.	750		

PLANT ENGINEERING: *Consulting assistance in plant layout to coordinate departmental operations, our experience dated from 1917 in this field.*

Such plant layout may be based on increasing production beyond present capacity, or it may be a rearrangement in this post-war period when operations are conducted under a new set of conditions.

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(*Concluded from page* 156)

mechanics causing scabbing, buckling and spalling. These tests indicate that there are at least three causes of these defects and that these three causes are interrelated. All of these causes have been recognized in the past, but their interrelation, especially their quantitative interrelation, is not known.

The first and simplest cause of these spalling defects is simply gas pressure. The foundrymen have always been conscious of this problem, but seem to have lost interest in it recently for more fashionable causes such as expansion and contraction. Many of the specimens immersed in molten steel, especially those in Part I, did evolve gas for the gas evolution could not only be seen but could be felt; the rod holding the specimen would vibrate. Not only would the specimen spall at that exact time, but many times the spalled sand could be seen rising to the surface of the steel. This type of spalling or scabbing action is more prevalent in green sand containing appreciable amounts of water.

At present not much more can be said of this type of spalling, other than that the reason for it is quite complex. Undoubtedly, the formation of a relatively impermeable glaze accentuates the defect, for many times only the glaze spalled off. There is some indication that there is a relation between the gas evolved and permeability, high gas content and low permeability causing this type of spalling, but more work is necessary before the relation can be established. Water, of course, is a potent gas former, but some sands are much more sensitive to water than others, reclaimed sand falling in this category. Perhaps it is the spent organic content of these sands forming gas in addition to that formed by the water that causes part of our troubles with reclaimed sand. The higher density and, therefore, smaller voids of a reclaimed sand at any given level of ramming mean lower permeability and should be a contributing factor.

The second cause of scabbing in these tests is currently fashionable—expansion of the sand. Spalling that could be traced to this cause is most evident when the specimens are exposed to radiant heat, i.e. when the cope spalls. The glaze that forms when molding sands come in contact with liquid steel at temperatures over 2900 F is so viscous and tenacious that the mold surface can withstand any amount of dimensional change encountered in the mold and not rupture.

The third cause of these defects has not been appreciated fully, for it is an important one. It only occurs when the sand is in contact with moving metal and is due to a lack of strength during the first few seconds steel foundry sands are in contact with liquid steel, before a glaze forms. This property could be called instantaneous hot strength and is simply dry strength or hardness retained for the first few seconds after the steel contacts the sand.

The action of the organic sprays containing resin or rubber in a volatile solvent is pretty good proof that such a property is required. These sprays could not change the expansion characteristics of the sand, for they are sprayed on the mold surface after the sand is rammed. They, if anything, increase the gas content of the sand. Nevertheless, their use results in a definite improvement in the behavior of some sands in contact with liquid steel (alternate immersion) and with radiant heat. This improvement has been checked in production in a number of foundries. Again it should be emphasized that these sprays decrease the resistance of some sands.

In production these three causes of scabbing and spalling are interrelated. Hard ramming, for example, decreases the permeability and therefore increases the probability of gas pressure causing spalling. At the same time it increases the density and increases the probability of spalling due to expansion. On the other hand, hard ramming will help the sand to hold together for the first few seconds and decreases the susceptibility of the sand to spalling or erosion by moving molten metal.

Theories Are Not New

These theories are not new, they have been recognized for years. However, the interrelation between these various causes of spalling or scabbing emphasizes the importance of quantitative knowledge. It is necessary to balance one bad behavior against one or more good behaviors. To do this we must not only recognize each one but understand the quantitative interrelation. Experiment by trial and error with even three variables is much too inefficient.

Summary Part II—It has been shown that cereal or organic additions to a steel molding sand result in an improvement in the behavior of the sands when air dried. The only advantage of these additions to sand that comes in contact with liquid steel before air drying is the resistance of some of them to over-ramming.

Each organic addition imparts a slightly different characteristic to the sand. However, they fall into two general groups. Corn flour and gelatinized corn flour impart "fluffiness" to the sand, and resist over-ramming; they do not result in a hard mold surface after air drying.

Lignin pitch and organic sprays in volatile solvent do result in a hard mold surface, but they do not resist over-ramming and defects caused by high sand density.

Dextrin imparts both properties to the sand. It does resist over-ramming but not to as great a degree as corn flour. It results in a fairly hard mold surface and one that resists spalling or erosion when the sand is in contact with moving steel.

The tests suggest that at least an economic advantage can be gained by judicious combination of organic additions, each added to impart a given property.

Three possible mechanisms are advanced as causes of spalling, buckling and scabbing in the steel foundry.

INSPECTION TRIP: Senior petroleum engineering students from the University of Texas and their professors, H. H. Power and A. E. Sweeney, shown on a recent visit to Lufkin Foundry & Machine Co., Lufkin, Tex., manufacturer of oil field equipment. These future oil field workers spent a day inspecting Lufkin Foundry plant facilities

John Selak has obtained building permit for construction of a foundry at 5039 West Jefferson Blvd., Los Angeles. New plant will be 80 x 80 ft and will cost about $33,000.

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The United States Graphite Company
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"We are very well pleased with the results obtained in using your product and we would be glad to recommend it to any other foundry for this particular application and use."

Yours very truly,

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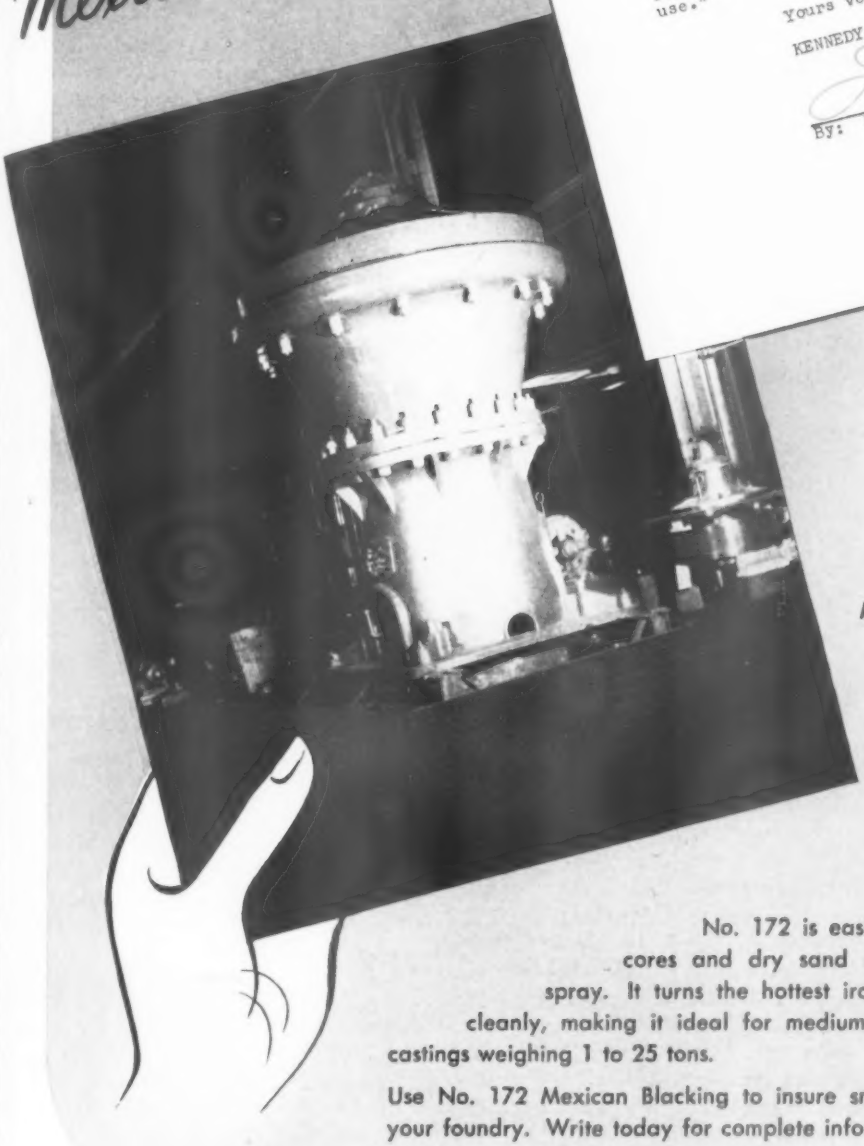
By: L. V. Murray, General Supt.



This excerpt of a letter from Mr. L. V. Murray, General Superintendent of the Kennedy-Van Saun Manufacturing and Engineering Corp., to The United States Graphite Company testifies to the excellence of No. 172 Mexican Blacking. A high quality wet blacking ready mixed with bond, No. 172 is easily and smoothly applied to cores and dry sand molds with swab, brush or spray. It turns the hottest iron and allows sand to peel cleanly, making it ideal for medium, extra large, and pressure castings weighing 1 to 25 tons.

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THE UNITED STATES GRAPHITE COMPANY • SAGINAW, MICHIGAN

STEEL FOUNDERS HOLD TECHNICAL, OPERATING MEETING

(*Concluded from page* 112)

Harder also described a heat-treated and tempered shot which has given excellent results.

Second part of the session was devoted to a discussion of factors governing the ease of flogging necked-down risers. Effect of shape of neck opening was the subject of a paper by E. H. Blanton, Atlantic Steel Castings Co., Chester, Pa., H. Alberts, Dodge Steel Co., Philadelphia, and C. M. Apgar, Taylor-Wharton Iron & Steel Co., High Bridge, N. J., which was presented by Mr. Blanton. Investigation indicated that square or rectangular openings permitted the risers to be broken off more easily than when the opening was circular. In the case of two or more risers it was observed that hot tearing was more evident, which also promoted easier removal and led the authors to suggest that the risers be located so that the natural restraining effect of the sand on contraction of the solidifying metal be employed to increase hot tearing.

Neck Opening Size Studied

Effect of size of neck opening was studied by K. V. Wheeler Jr., American Steel Castings Co., Newark, N. J., and F. V. Bortz, Treadwell Engineering Co., Easton, Pa., and the results were given by Mr. Wheeler. As might be expected, the smaller the neck opening the fewer the blows required to remove the riser. However, minimum size is dictated by the section to be fed, possibility of hard spots due to carbon segregation, etc., and as a consequence it is necessary to calculate the proper opening. David Zuege, Sivyer Steel Casting Co., Milwaukee, discussed the effect of temperature at the time of flogging off the riser, and stated that investigation showed a sharp increase in the number of blows needed for removal as the temperature rose from 50 to 200 F in the case of carbon steel. In the case of an alloy steel containing 1.12 per cent Mn, 0.58 Cr, 0.58 Ni and 0.19 Mo there was a slow but gradual increase in the number of blows. Mr. Zuege called attention to the fact that in summer with its higher atmospheric temperatures, removal of risers would require greater effort than in the cooler months; at least in the case of carbon steel castings.

Effect of chemical composition was described by J. H. Lowe, Wehr Steel Co., Milwaukee, who stated that increase in carbon content decreases the number of blows required to flog the riser, and that changes in manganese, chromium, nickel, etc., apparently have little effect. He also mentioned that blind risers are easier to remove by flogging than open risers.

At the close of the morning session E. D. Flintermann, president, presented a wrist watch to Tullie Taylor in recognition of his work for the Steel Founders' Society.

Friday afternoon session was a continuation of the morning program, and was under the direction of J. O. Shive, Sterling Steel Casting Co., East St. Louis, Ill., and I. M. Emery, Massillon Steel Casting Co., Massillon, O. First paper by R. A. Evans, Pittsburgh Steel Foundry Corp., Glassport, Pa., dealt with a study of grinding wheels used with portable air-operated grinders. The author pointed out that the most satisfactory wheel usually is a compromise between longest life and lowest labor cost. By use of a simple test whereby the amount of metal removed from a casting test-piece and the quantity of abrasive lost by the wheel can be determined, an index of grinding wheel performance may be obtained, according to Mr. Evans.

Instrument Measures Efficiency

Second paper, by D. R. Stewart, Stewart Instrument Co., Detroit, described an electrical instrument for determining energy input and operating time of a grinding machine. These data plus the amount of metal removed from the castings can be employed to ascertain labor performance. Final paper at the session, by R. E. Chapman, American Steel Foundries, Granite City, Ill., related to chipping operations, and described equipment and procedures. Mr. Chapman said for best results in the chipping department, it is necessary to use considerable care in selection of foremen and chippers. He also told how chippers are trained in his plant. For two weeks the apprentice works by himself under the direction of a supervisor. Then he is paired with an experienced chipper for such time until he gains a reasonable amount of skill, whereupon he is teamed with another apprentice of equal caliber. Approximately a year's training is needed to become a class *A* chipper.

Closing technical session on Saturday morning, with S. E. Mueller, Falk Corp., Milwaukee, and J. D. Genger, Pacific Steel Casting Co., Berkeley, Calif., presiding, was devoted to methods of heading and gating a 360-lb herringbone six-spoke gear blank to meet Navy radiographic specifications of class 3 castings and magnetic particle inspection. The problem was studied by each of the eight divisions of the Steel Founders' Society, and the data presented by a spokesman from each. They included A. L. Wentzel, Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.; E. J. Dunbeck, Symington-Gould Corp., Rochester, N. Y.; Frank Copeland, American Cast Iron Pipe Co., Birmingham, Ala.; T. J. Nichols, Fort Pitt Steel Casting Division, Pittsburgh Steel Foundry Corp., McKeesport, Pa.; C. J. Trump, Machined Steel Casting Co., Alliance, O.; R. C. Wood, Minneapolis Electric Steel Castings Co., Minneapolis; R. L. Edmiston, Sterling Steel Casting Co., East St. Louis, Ill., and Ralph N. Schaper, Westlectric Castings Inc., Los Angeles.

Variety of Procedures Used

A wide variety of procedures were proposed, including atmospheric pressure risers attached to the periphery outside of the rim opposite the spokes; just offset from the spoke junctures, between alternate spokes, and on the inside of the rim. Others used open risers on the rim at the spoke juncture, and in one case a solid cast iron chill around the periphery. Gating methods included those into the underside of the rim; into one of the risers located on the periphery, directly into the top of the hub; into the bottom of the hub with a horn gate, and into all the risers around the periphery. Data were presented on total costs of the various methods, and mention was made that many of the procedures employed were predicated on flasks and other equipment available.

The conference concluded with an industry luncheon, with J. F. Lacey as toastmaster. Speakers were E. D. Flintermann, president of the society; W. F. Wright, Sawbrook Steel Castings Co., Lockland, O., and 1946 medallist of the Technical and Operating Division; J. F. Ewing, Symington-Gould Corp., Rochester, N. Y., and chairman of the society's National Safety Committee, and Leslie C. Thellemann, executive vice president of the society.

Names New Agents

Detroit Electric Furnace Division of Kuhlman Electric Co., Bay City, Mich., has established new foreign representatives for South America and Mexico.

In Brazil all sales are handled by Equipamentos Industriais "EISA" Ltda., Rua Marconi, 23 Sao Paulo, with a branch office in Rio De Janeiro, Avenida Graca Aranha 333, and agents in Curitiba, P. Alegre, Belo Horizonte and Recife. "EISA" is the successor of the former "Sociedade de Engenharia Industriais Ltda., insofar as all representations held by the latter were transferred to "EISA."

M. Castellvi Inc., 150 Broadway, New York 7, is the representative in Argentina, Chili, Colombia, Peru, Ecuador, Bolivia, Uruguay and Venezuela. Casa Covacevich, Paseo de La Reforma 12, Mexico D. F. represents the company in Mexico.

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STANDARD SPECIFICATIONS FOR GRAY IRON CASTINGS

ASTM Designation: A 48-46. Adopted, 1936; Revised, 1941, 1946

Scope

1. These specifications cover general gray iron castings not covered by other existing specifications of the American Society for Testing Materials and apply to gray iron castings where strength is a consideration. It is a purpose of these specifications to classify cast irons in respect to tensile strength.

Tensile Strength Classification

2. Gray iron castings conforming to these specifications shall be known and listed by classes (Notes 1, 2, and 3), according to the minimum requirements as to tensile strengths of test bars as follows:

Class	Tensile Strength, min., psi.
No. 20	20,000
No. 25	25,000
No. 30	30,000
No. 35	35,000
No 40	40,000
No. 50	50,000
No. 60	60,000

Transverse Test

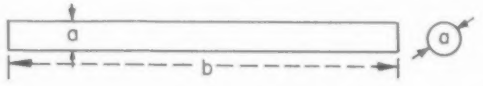
3. (a) Transverse or flexure tests shall be optional. When specified, the breaking loads prescribed in Table I shall apply.

TABLE I—Transverse or Flexure Breaking Loads

Transverse or flexure test bar Span length Class	0.875 in. in diameter 12-in. supports Breaking Load at Center, min., lb.	1.2 in. in diameter 18-in. supports Breaking Load at Center, min., lb.	2.0 in. in diameter 24-in. supports Breaking Load at Center, min., lb.
No. 20	900	1 800	6,000
No. 25	1,025	2,000	6,800
No. 30	1,150	2,200	7,600
No. 35	1,275	2,400	8,300
No. 40	1,400	2,600	9,100
No. 50	1,675	3,000	10,300
No. 60	1,925	3,400	12,500

(b) By agreement between the manufacturer and the purchaser, deflection values in the transverse of flexure test may be specified (Note 4).

(c) The transverse or flexure breaking loads prescribed in Table I are based on actual averages of transverse test loads for each class of casting. It is not implied by these specifications that the ratio of tensile strength to transverse load is constant. By agreement between the manufacturer and the purchaser, tensile strength and transverse tests may be made and a range of transverse values determined. These values will then supersede the values prescribed in Table I.



Transverse Test Bar	Dimensions—Diameter, in.	Dimensions—Length, in.	Distance Between Supports in Transverse Test, in.
A	0.875	15	12
B	1.20	21	18
C	2.00	27	24

Fig. 1—Transverse or flexure test bars

(d) When an iron is specified by class (No. 20, No. 25, etc.) and the transverse or flexure test bar fails to meet the load requirements prescribed in Table I, then the manufacturer shall have the right to have tested a tension test specimen machined from a broken end of the transverse test bar. If this tension specimen conforms to the requirements of the specified class, as given in Section 2, the class requirements shall be considered as having been met, irrespective of the transverse or flexure breaking load.

Test Bars

4. Test bars shall be cast separately from the casting. Three standard sizes of transverse or flexure test bars are available under these specifications as shown in Fig. 1 (Note 5). Tension test specimens shall be machined from the transverse test bars to the dimensions shown in Fig. 2.

Correlation of Test Bar and Casting

5. (a) The manufacturer and the purchaser shall agree upon the controlling section of the casting. Then the corresponding test bar shall be used as follows:

Controlling Section of Casting, in.	Test Bar	Nominal Diameter of Test Bar as Cast, in.
0.50 and under	A	0.875
0.51 to 1.00	B	1.20
1.01 to 2.00	C	2.00
Over 2.00	Test bar C may be used or a larger test bar may be used by agreement between the manufacturer and the purchaser.	

(b) The correlation in Paragraph (a) is only approximate and may need modification for complicated castings. The test bar size for a given casting may then be determined by agreement between the manufacturer and the purchaser.

(c) When the controlling section is very heavy in comparison to other sections of the casting and if maximum strength is sought in the controlling section, it is possible that chilled spots may be found in the light sections. In such cases it may be necessary to (1) use a lower strength class for the controlling section, or (2) modify the design to provide more section uniformity.

Molding and Pouring Test Bars

6. Unless otherwise agreed upon by the manufacturer and the purchaser, test bars shall be made under the same sand conditions as the castings (Notes 6 and 7). The bars shall be poured from ladles of iron used to pour the castings. The test bars shall receive the same thermal treatment as the castings. In the case of heat

STANDARD SPECIFICATIONS FOR GRAY IRON CASTINGS

ASTM Designation: A 48-46. Adopted, 1936; Revised, 1941, 1946

treatment, the test bars shall be treated adjacent to the castings they represent.

Tensile Strength Test Procedure

7. Tension test specimens (Fig. 2) shall fit the holders of the testing machine in such a way that the load shall be axial. The use of self-aligning shackles is recommended (Note 8). After reaching a stress equivalent to 15,000 psi, the speed of the moving head of the testing machine shall not exceed ⅛ in. (0.125 in.) per min.

Explanatory Notes

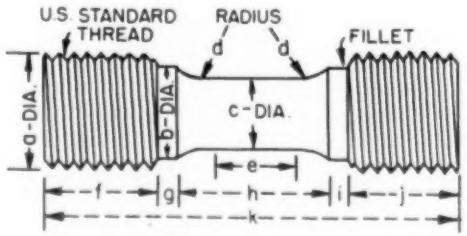
Note 1.—Classes Nos. 20, 25, and 30 cover the ordinary grades of gray cast iron. Classes Nos. 35, 40, 50, and 60 would be considered high-strength irons, particularly in medium and heavy sections.

Note 2.—The higher strength irons are usually more expensive to produce and machine.

Note 3.—In the transverse or flexure test, it is recommended that the deflections at fracture be recorded and reported.

The modulus of rupture for any bar tested under these specifications can be ascertained by application of the following formula:

$$\text{Modulus of rupture} = \frac{2.546LS}{D^3}$$



Dimensions of Tension Test Specimens, in.

Dimension	Specimen A	Specimen B	Specimen C	Dimension	Specimen A	Specimen B	Specimen C
a	¾	1⅛	1⅜	*f*	1.00	1.00	1¾
b	⅝	1⅛	1⅞	*g*	0.25	0.25	⅝
c	0.505	0.750	1.25	*h*, min.	1.25	1.50	2¼
d	1.00	1.00	2.00	*i*	0.25	0.25	⅝
e[a]	Shall be equal or greater than *c* (diameter)			*j*	1.00	1.00	1¾
				k, min.	3.75	4.00	6⅜

[a] Length of parallel.

Fig. 2—Tension test specimen machined from transverse or flexure test bar

Where:

L = span length or distance between supports in inches,
S = breaking load in pounds, and
D = diameter of the test bar in inches.

Deflection values have been omitted from these specifications because the desired deflection would be governed by the use of the iron. In some cases a maximum value would be specified because a stiff iron is desired, and in other cases minimum values would have to be specified because a flexible iron is required. Consequently, the deflection figures should be reached by agreement between the manufacturer and the purchaser.

The use of modulus of elasticity gives a definite load-deflection relationship, which is superior to a specification for deflection unless that specification provides for increase in deflection with increase in load. The maximum modulus of elasticity could be specified if toughness is desired or a minimum value could be specified if stiffness is desired. For the 1.20-in. diameter test bar the formula for modulus of elasticity is as follows:

$$\text{Modulus of elasticity, psi} = \frac{\text{Load in pounds}}{\text{Deflection in inches}} \times 1194$$

Note 4.—Test bars shall be plain, cylindrical shapes as shown in Fig. 1. Where bars are cast on end, allowance for draft may be made. However, the diameter at the center of the length must correspond to the nominal diameter, within the permissible variations shown as follows:

Test Bar	Permissible Variations, in.
A	± 0.05
B	± 0.10
C	± 0.10

Tension test specimens "cast to size" are not recognized in these specifications.

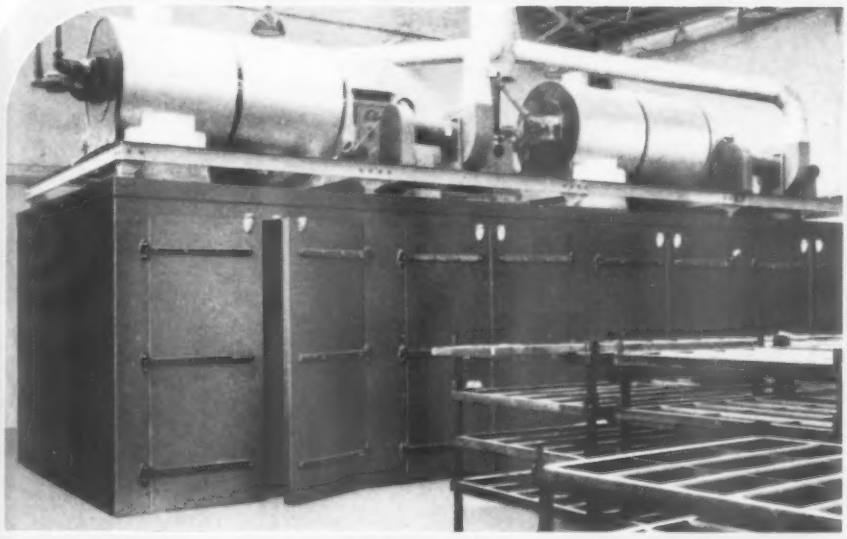
Note 5.—A sound test bar is desired. Several methods of making transverse or flexure test bars are shown in Figs. 3, 4 and 5. All of these methods of casting have been used and found to produce satisfactory results.

Note. 6.—Test bars shall not be cleaned by tumbling unless the castings are so cleaned, or unless agreed upon by the manufacturer and the purchaser.

Note 7.—The use of ball and socket holders in the tensile strength test is recommended. Tests made under conditions where eccentric loadings may occur will give erroneous results.

(To be concluded next month)

LANLY *Dual Fuel* OVENS



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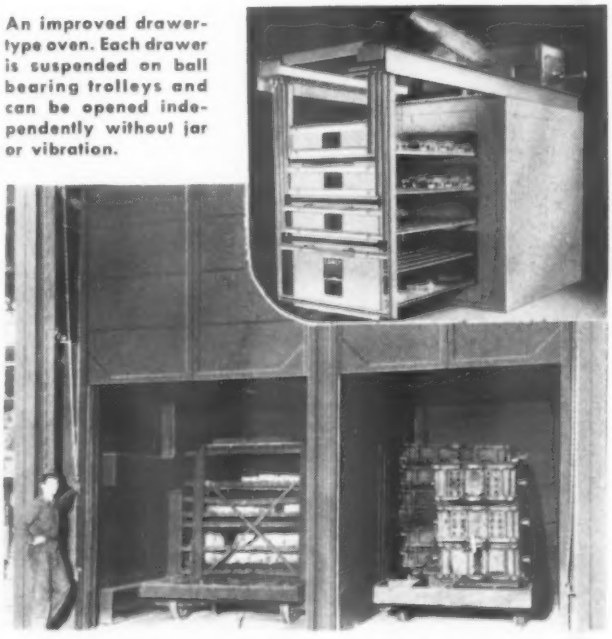

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Activities of Foundry GROUPS

St. Louis

OFFICERS of the national AFA visited the St. Louis Chapter on May 8. Sheldon V. Wood, national president, and Herbert Scobie, of the Chicago office of the AFA, breakfasted with the reception committee and at noon the visiting group was entertained at a luncheon. Representatives of many of the city's large foundries and supply houses were present.

In the afternoon Messrs. Wood and Scobie attended an officers and directors meeting at which the usual items of business were discussed.

The evening meeting at the York Hotel had the largest attendance of the year. The chapter was celebrating past chairman night, lapel pins were presented to six past chairmen, and letters of regret at being unable to attend were read from several others by Secretary Robert E. Woods.

Sheldon V. Wood talked to the chapter on the activities of the association, giving a resume of chapter activities and benefits of the association to foundries and members.

James L. Yates, National Engineering Co., Chicago, spoke on "Engineering as it Affects the Foundry." He first reminded the group of the present difficulties in getting men to work in the foundry industry and attributed much of the difficulty to poor housekeeping. It was suggested that good housekeeping and dust control can offer much to the improvement of working conditions and obtaining new help.

Mr. Yates also outlined the effective use of compressed air in the foundry and the proper installation and utilization of compressed air equipment. Some of his comments were illustrated with stereopticon slides.—*J. W. Kelin, Federated Metals Division.*

Central New York

LAST TECHNICAL session of the Central New York Chapter of the AFA was held at Onondaga Hotel, Syracuse, N. Y., May 9. George Johnstone, president, Johnstone Foundries Inc., Grove City, Pa., addressed the 70 members and guests present on the subject of "Casting Defects."

Mr. Johnstone claimed that many foundries have come to accept 5 to 10 per cent scrap as a natural procedure while those using controls and periodic checks are working with scrap losses of 1 per cent or less. These foundries with the high scrap percentage are the ones that are holding the foundry industry back, sometimes even forcing customers to use other manufacturing processes rather than castings.

According to Mr. Johnstone, top management in many cases is responsible for this high scrap condition. By not supplying good working conditions, proper equipment and tools and a system of controls and checks, carelessness is invited. It has been proved that money spent in keeping foundries clean, equipment in good repair and the maintenance of laboratories with competent operators has reduced scrap losses to such a degree that the investment was more than justified.

Other advantages of good housekeeping cited by Mr. Johnstone are improvement of quality and the attraction of a higher type of employee.

Using slide pictures the speaker showed how proper controls are beneficial. These controls covered flask equipment, patterns, gating and risering, metal temperature, pouring time and sand testing. Tests taken of pilot runs to be used as standards in the cleaning and salvaging departments also help to reduce scrap losses.—*J. A. Feola, Crouse-Hinds Co., chairman.*

ST. LOUIS: Views at the special luncheon given by the St. Louis Chapter of the AFA, May 8, in honor of visiting officers of the national association. Photos courtesy of Paul Schwarz, National Bearing Metals Division, American Brake Shoe Co., St. Louis

Chesapeake

GUEST speaker C. A. Brashares, Harbison-Walker Refractories Co., Pittsburgh, spoke on "Foundry Refractories" at the April meeting of Chesapeake Chapter of the AFA.

In discussing cupola refractories in the gray iron foundry, Mr. Brashares described the three ways of making block —extruded, power press and hand made —as well as their advantages and principal uses. Silica stone chosen for its density is highly resistant to iron oxide, although silica brick will give the best service for hard duty intermittant operation, according to the speaker.

Malleable iron foundries, he continued, use a super duty, hard burned, fireclay brick for the side walls and bottoms of air furnaces. Electric furnace roof refractories are usually silica, while either silica or rammed magnesite is used for the bottoms, depending on the operation.

"Equipment Night" was the theme for Chesapeake Chapter's May meeting. A. Leslie Gardner, advertising manager, Pangborn Corp., conducted the meeting. Victor Stine, vice president, Pangborn

(*Continued on page* 168)

Foundry management, watching mounting costs, sees profits in MOGUL. This perfect Green Bond makes money because it decreases drying time, yields smooth cores and reduces discards. MOGUL works profitably with pitch or resin because cores can be handled warm. For both green and dry strength use MOGUL in cores.

KORDEK is an equally perfect Dry Bond. Used in smaller quantities than most dry binders, KORDEK produces better quality castings with fewer discards.

CORN PRODUCTS SALES CO. • 17 BATTERY PLACE • NEW YORK 4, N. Y.

(*Continued from page* 166)

Corp., arranged for showing motion pictures of the Ford Motor Co. foundry making cylinder blocks, and also other film illustrating a variety of equipment. —*J. Arthur Reese, Koppers Co. Inc.*

Southern California

NEW officers elected for 1947-48 were announced at the May 7 meeting of Southern California Chapter of the AFA. Henry E. Russill, Eld Metal Co. Ltd., is the new president; L. O. Hofstetter, Brumley-Donaldson Co., vice president; Earle Shomakes, Kay-Brunner Steel Products Inc., treasurer, and John Wilson, metallurgical engineer, secretary.

Directors for the new term are Clarence E. Holmer, Kinney Iron Works; Arthur B. Lamb, Independent Foundry Supply Co.; Myron Niesley, California Testing Laboratories; A. L. Goodreau, G-B Brass & Aluminum Foundry Inc., and E. K. Smith, foundry consultant.

Principal address of the evening was by Tom Barlow, research engineer, Battelle Memorial Institute, Columbus, O., who described modern cupola practice.

Mr. Barlow stated that much melting trouble is directly traceable to dirty air in cupola blowers. Close supervision of filters and other parts of the air system should become a part of melting practice. The use of control instruments on air cleaners is not enough; this instrument may become fouled and thus show faulty readings.

He added that another source of inconstant air pressure is to be found in voltage input variation, a factor difficult to control.

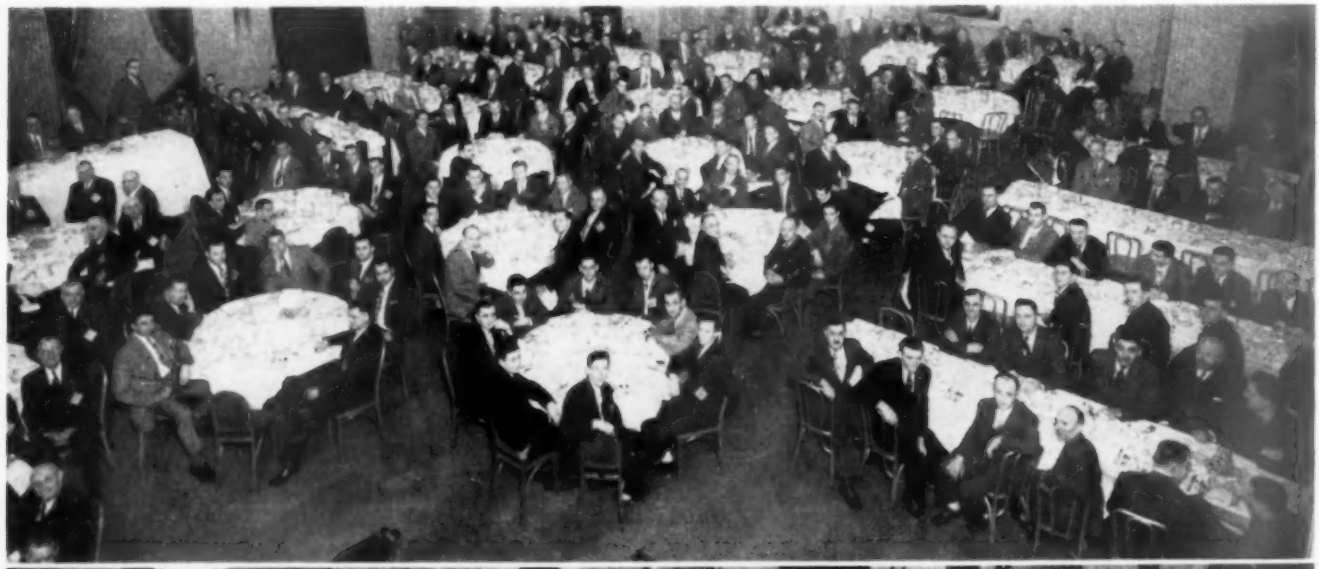
Leonard J. Roach, Los Angeles County supervisor, gave the coffee talk, outlining various points of smog-control legislation which aims at smoke-fog elimination in the area.—*Maurice Beam*

Pittsburgh

DISCUSSION of a relatively new development in foundry practice—chemically coated sand—drew an unusual large attendance at the Apr. 21 meeting of the Pittsburgh Foundrymen's Association. Norman J. Dunbeck, Eastern Clay Products Co., Jackson, O., addressed the group on how the coated sand is prepared and used.

Prefacing his remarks with the statement that it is still in the experimental stage, Mr. Dunbeck stated chemically coated sand is ordinary clean silica sand

(*Continued on page* 170)



WISCONSIN: Views of Old Timers' and Apprentice Night held May 9 by Wisconsin Chapter of the AFA at Schroeder Hotel, Milwaukee. Approximately 450, including 75 old timers and 109 apprentices, attended the party. Photos courtesy John Bing, A. P. Green Fire Brick Co.

HYDRO ELECTRIC LIFT TRUCK

DEPENDABLE

POWER

EXIDE-IRONCLAD POWER
AND BATTERY ELECTRIC TRUCKS

Keep materials moving steadily, safely, at minimum cost . . . .

You can make substantial savings in materials handling costs by using the modern, efficient method employed by so many others throughout your industry. They have delegated their loading, unloading, lifting, hauling, placing and stacking to the time-and-cost-cutting team—battery electric trucks and Exide-Ironclad Batteries.

Exide-Ironclad Batteries have the high power ability, the high maintained voltage and the high capacity that materials handling requires. You can always count on Exide-Ironclad Batteries for dependability, long-life and ease of maintenance.

Write us for a FREE copy of Exide-Ironclad Topics which contains "Case Studies" of materials handling problems. It tells how to cut handling costs up to 50% . . . covers latest developments in handling materials from receiving to shipping.

THE ELECTRIC STORAGE BATTERY COMPANY
Philadelphia 32
Exide Batteries of Canada, Limited, Toronto

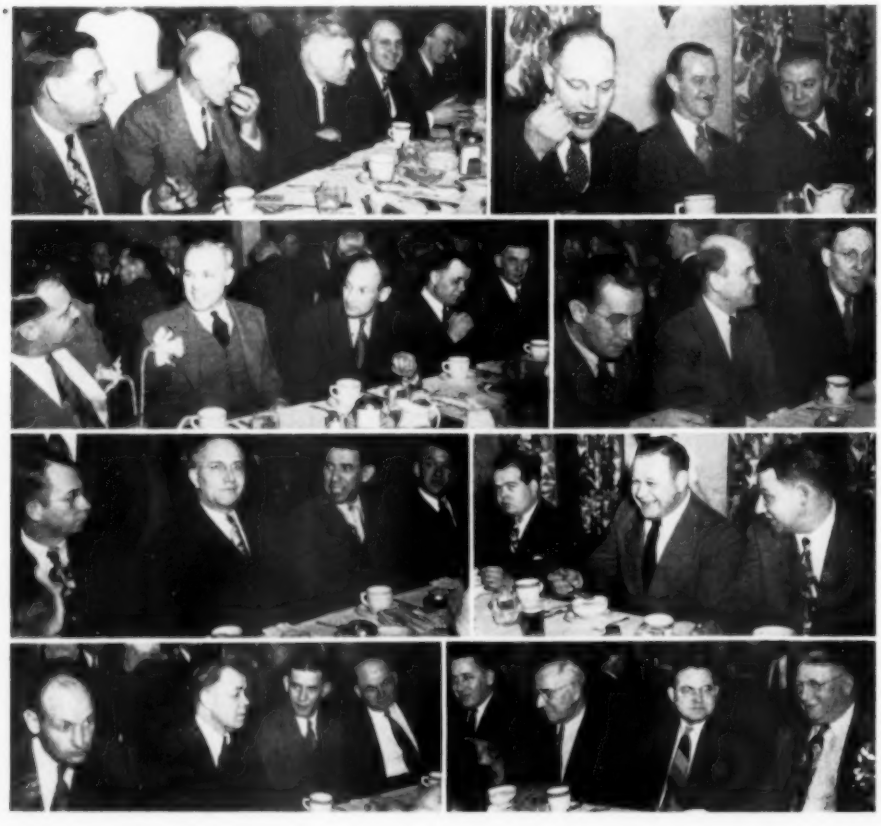
HYDRO ELECTRIC LIFT TRUCK

(*Continued from page* 168)
on the surface of which is put a free-flowing liquid plastic coating which is both refractory and reactive. The coating is made plasticizable through addition of a solvent material after coating the sand, which softens the coating and makes it a little tacky. After coating the sand is put through a drier to fix and bake the coating on the grain.

The plastic is nonthermal setting and not affected by temperatures as far as setting hard or binding property is concerned, Mr. Dunbeck said; it contributes nothing to dry strength or hot strength. The coating as it is applied to the grain is almost pure carbon, with a fusion point around 5000 to 6000 F.

A catalyst is added to the plastic coating to initiate combustion at very low temperatures. Seacoal, pitch or any of the conventional casting elements are eliminated. This combustion proceeds to completion; there is no ash. In burning the coating does not go through any coking phases and there is no pitch condition; it burns off and is completely gone. After each use of the sand it is rebonded by the addition of clay and recoated with liquid plastic.

The chemically coated sand is workable; it feels damp; it needs less tempering water than conventional sands. Tests to date indicated the sand mixes faster, is easier to control and has a high flowability.—*Joseph C. Sullivan.*



SAGNAW VALLEY: Views of the May 1 meeting (above) when Ralph M. Heintz, Jack & Heintz Precision Industries Inc., Cleveland, was the principal speaker, and the Apr. 3 meeting (below), which was addressed by J. L. Lucas, Meehanite Metal Corp., New Rochelle, N. Y.

Saginaw Valley

MEMBERS and guests of the Saginaw Valley Chapter of the American Foundrymen's Association heard Ralph M. Heintz, Jack and Heintz Precision Industries Inc., Cleveland, speak on "Die Casting" at the chapter's regular monthly meeting May 1, at Fischer's Hotel, Frankenmuth, Mich.

Mr. Heintz gave a good account of his company's die casting practice and exhibited many intricate light metal die castings. He is enthusiastic about light metals and believes that they have a wide field only partially explored at present.

Election of chapter officers was held at the meeting. They are: M. V. Chamberlin, Dow Chemical Co., chairman; O. E. Sunstedt, General Foundry & Mfg. Co., vice chairman, and F. S. Brewster, Dow Chemical Co., secretary-treasurer.

Directors for 3-year terms are: C. A. Tobias, General Motors Institute; H. H Wilder, Eaton Mfg. Co. and J. J. Clark. —*F. S. Brewster, Dow Chemical Co., Bay City, Mich.*

Western New York

WILLIAM A. HAMBLEY, general manager, Slinger Foundry Co., Slinger, Wis., spoke on "Casting Defects" before 72 members and guests of Western New York Chapter of the AFA, May 9, at Hotel Touraine, Buffalo.

Scrap losses, he pointed out, have increased the past three months because of acute shortages of raw materials, poor quality of coke and reduction of pig iron in the metal charges. He emphasized what each 1 per cent in scrap losses means to foundry management in dollar losses.

To cure a defect, a proper analysis must first be made to determine the real cause. Each defect has a basic or contributing cause. For instance, a blow has certain characteristics, so has a shrink, and the correction of all such defects requires a careful and intelligent analysis on the part of foundry supervision and the metallurgist.

A name has been selected for the chapter's newspaper of which Frank E. Bates is editor. Members were urged to continue sending in news items of interesting chapter activities.

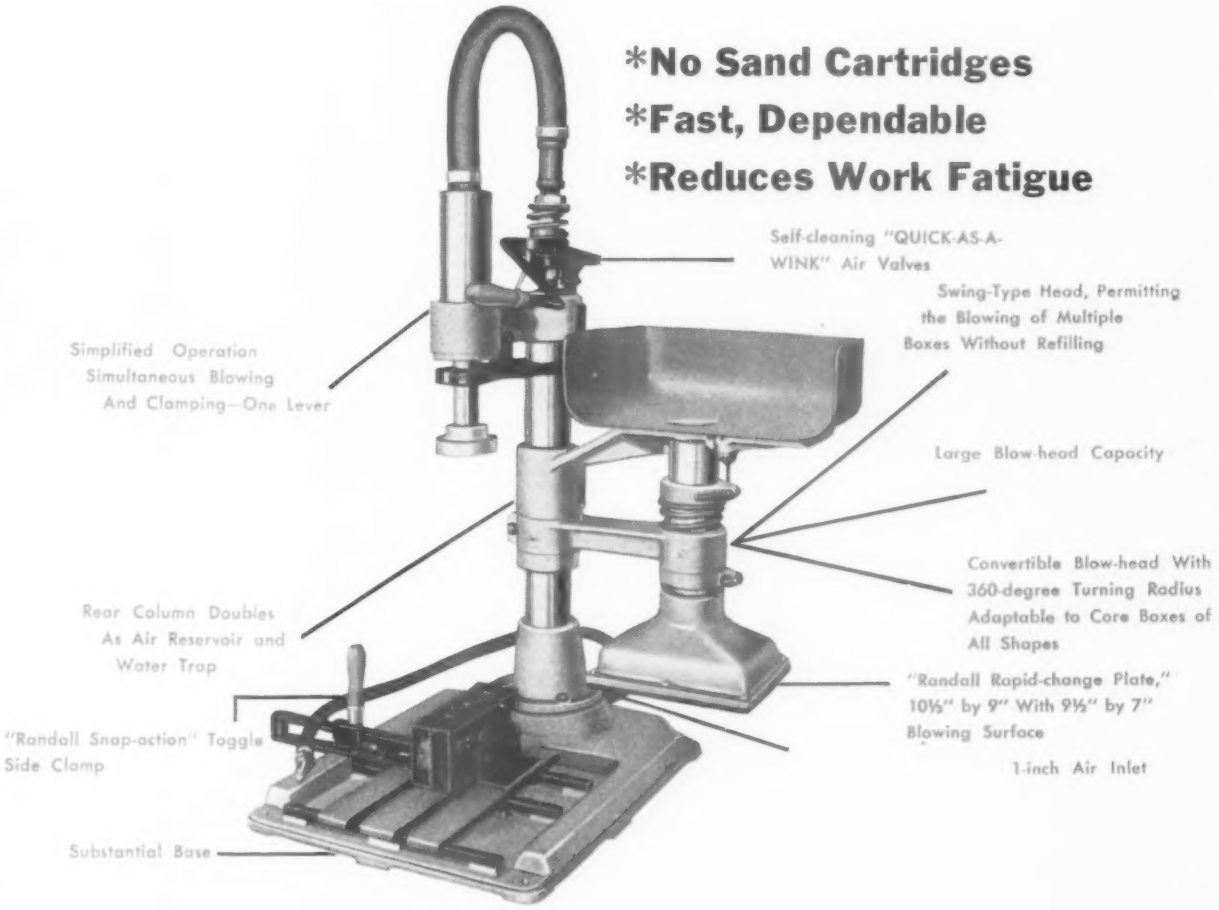
Officer and director nominations for next year were announced: Chairman Elliot R. Jones, Lumen Bearing Co.,

(*Continued on page* 172)

NEW RANDALL CORE BLOWER

With CONVERTIBLE, SWING-TYPE HEAD

***No Sand Cartridges**
***Fast, Dependable**
***Reduces Work Fatigue**


Self-cleaning "QUICK-AS-A-WINK" Air Valves
Swing-Type Head, Permitting the Blowing of Multiple Boxes Without Refilling
Simplified Operation Simultaneous Blowing And Clamping—One Lever
Large Blow-head Capacity
Convertible Blow-head With 360-degree Turning Radius Adaptable to Core Boxes of All Shapes
Rear Column Doubles As Air Reservoir and Water Trap
"Randall Rapid-change Plate," 10½" by 9" With 9½" by 7" Blowing Surface
"Randall Snap-action" Toggle Side Clamp
1-inch Air Inlet
Substantial Base

A single motion of the left hand clamps the core box in place, a single motion of the right hand simultaneously clamps the head and blows the cores. *It's as simple as that* with the new RANDALL CORE BLOWER, the latest contribution to the modernization of the foundry industry.

Quality cores are produced fast by the RANDALL, and in any business *speed plus quality means economy, and economy means profits . . . .*

But the superiority of the RANDALL isn't limited to the actual core-blowing operation alone. Its *swing-type head,* possessing a large sand capacity, dispenses with sand cartridges and the costs and extra motions they involve, at the same time permitting the blowing of multiple cores without refilling. The *360-degree turning radius* of the head makes the machine readily adaptable to core boxes of all shapes.

The many other features of the RANDALL include the RANDALL RAPID-CHANGE PLATE, measuring 10½ x 9" and boasting a blowing surface of 9½ x 7"; the RANDALL SNAP-ACTION TOGGLE SIDE CLAMP; an ability to conserve air; and, above all, unquestionable reliability.

All of these features combine with many more to make the RANDALL CORE BLOWER the efficient core-making unit it is, and promise foundrymen real relief from outmoded and expensive core-making methods. And the RANDALL CORE BLOWER can be depended upon to maintain such a standard of service for years.

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Randall
"DESIGNED TO PRODUCE"

BLOW MACHINE COMES COMPLETE WITH CLAMP

THE RANDALL FOUNDRY EQUIPMENT CORPORATION, Newburgh Station, Cleveland 5, Ohio

(*Continued from page* 170)

Buffalo; vice chairman Martin J. O'Brien Jr., Symington-Gould Corp., Depew, N. Y.; secretary Fred L. Weaver, Weaver Material Service, Buffalo, and treasurer Martin W. Pohlman, Pohlman Foundry Co. Inc., Buffalo.

Directors with terms expiring in 1950: Leonard Greenfield, Samuel Greenfield Co., Buffalo; Carl A. Harmon, Hanna Furnace Corp., Buffalo and Edward J. Roesch, American Brake Shoe Co., Brake Shoe & Castings Division, Buffalo. Retiring chairman, Henry C. Winte, Worthington Pump & Machinery Corp., Buffalo, becomes a director for one year. —*Leo A. Merryman, Tonawanda Iron Corp.*

Birmingham

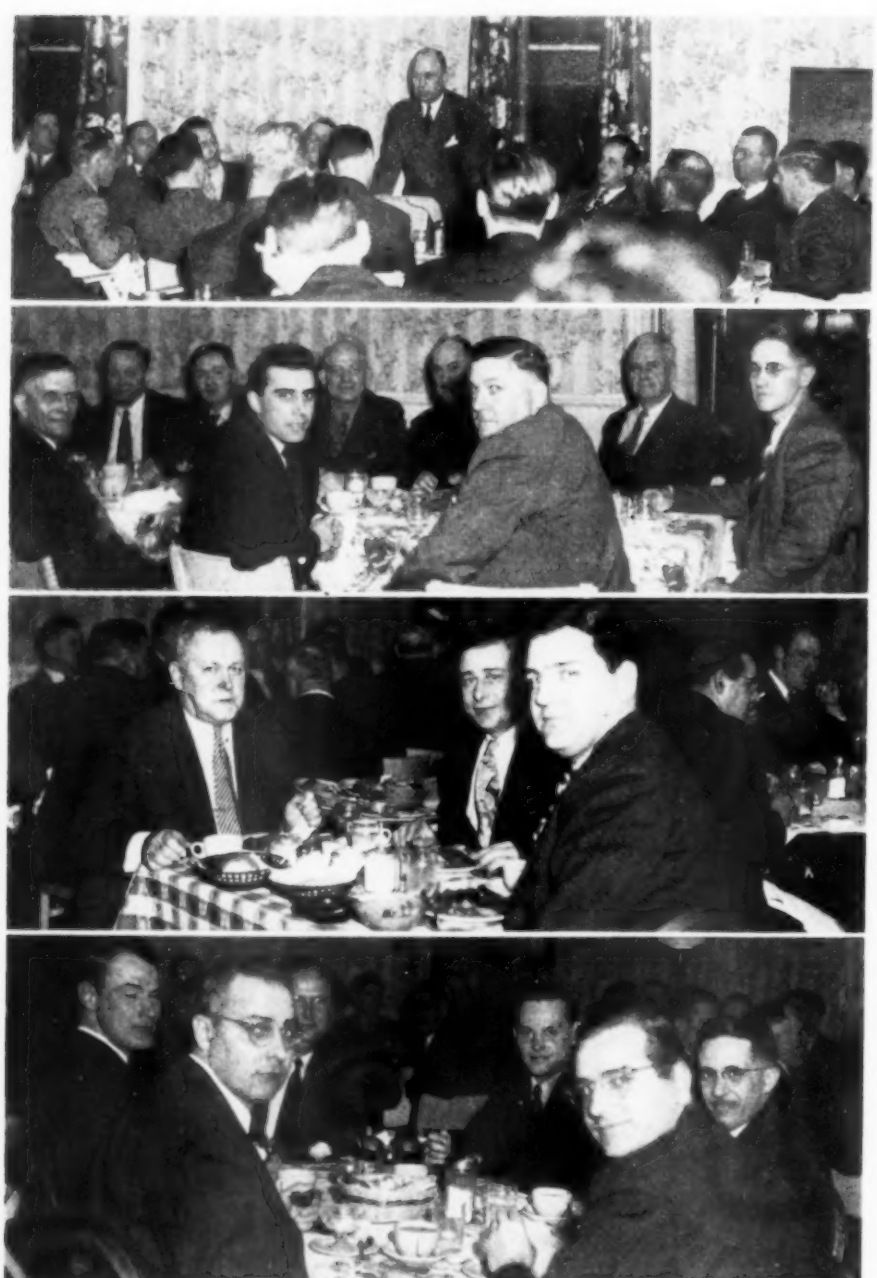
W. E. JONES, Stockham Pipe Fittings Co., has been elected chairman of the Birmingham District Chapter of the AFA for the 1947-48 season. Other officers elected are James T. MacKenzie, American Cast Iron Pipe Co., vice chairman and Fred K. Brown, Adams, Rowe and Norman Inc., re-elected for his fifth term as secretary-treasurer.

New members elected to the board of directors for two years are Fred Middleton, Jackson Industries Inc., and Frank T. Hamilton, Rudisill Foundry; elected for one year are J. E. Getzen, Harry G. Mouat Co., and Tom H. Benners Jr., T. H. Benners & Co.

Members re-elected to the board are J. A. Woody, A. S. Holberg, J. T. Gilbert, Dan B. Dimick, C. P. Caldwell and Thomas Bellsnyder.

A quiz program on various phases of foundry technology was held at the last regular meeting at which Morris Hawkins, Stockham Pipe Fittings Co., was chairman and kept the questions flying at the following board of experts: Dan B. Dimick Jr., gray iron; C. K. Donoho, steel; Elliott Cranford, dry sand cores; R. W. Sandelin, metallurgical; Hammond Wood, coke, and L. L. Durdin, brass.

T. H. Benners Jr., retiring chairman, was honor guest at a dinner preceding the technical session.—*J. P. McClendon, Stockham Pipe Fittings Co.*



CENTRAL MICHIGAN: One of the early meetings of what now is the 38th chapter of the AFA—the Central Michigan Chapter. These views were taken at a meeting Apr. 8 in Marshall, Mich., when 78 representatives of 35 foundries heard Charles B. Schureman (top panel), Baroid Sales Division, National Lead Co., discuss synthetic molding sand problems

Central Michigan

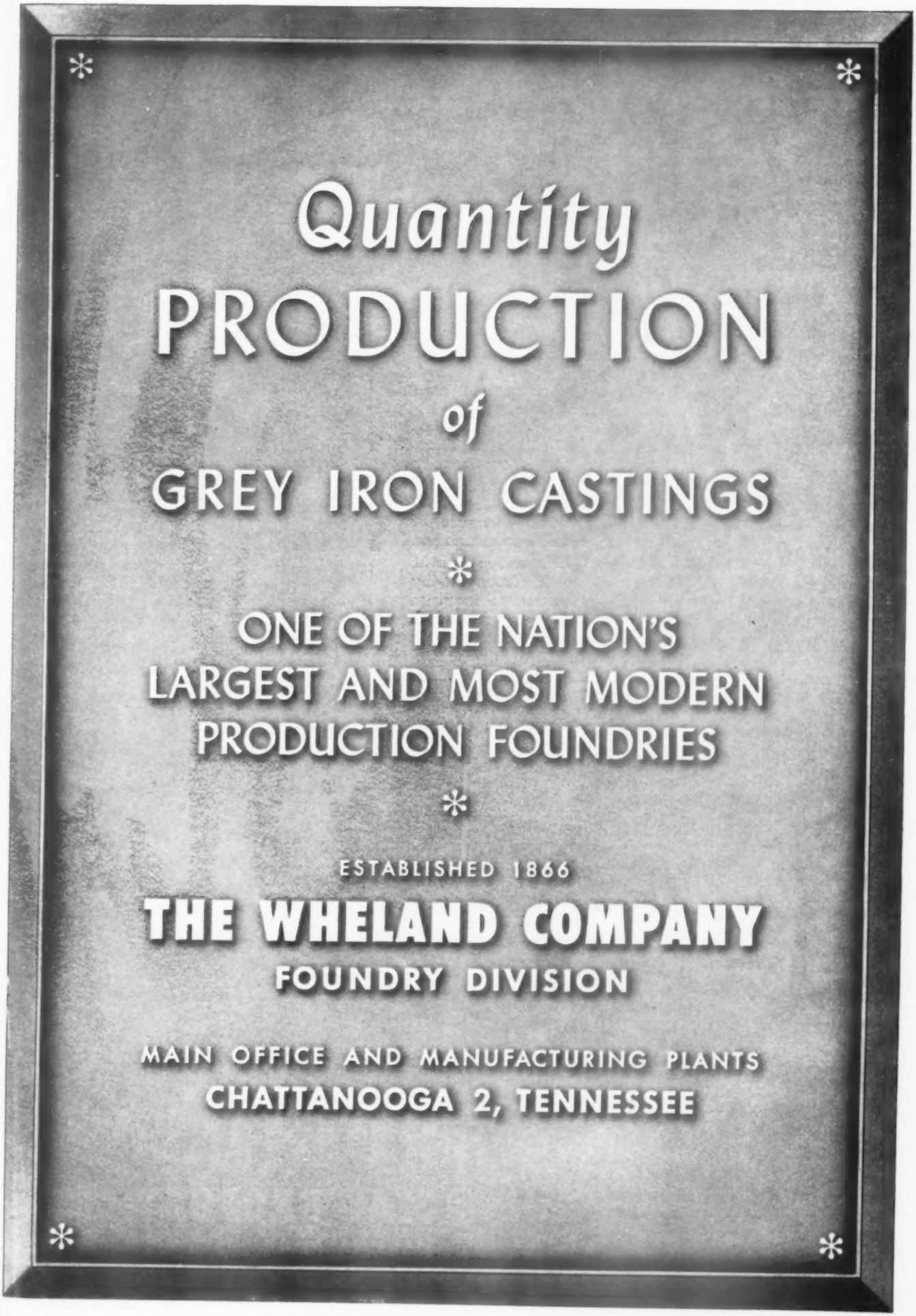
IN ITS official status as Central Michigan Chapter of the AFA—following authorization of its formation by the national board of directors during the recent AFA convention—the new chapter held its first meeting May 20 at the Schuler Hotel, Marshall, Mich. Chairman Douglas J. Strong, Foundries Materials Co., Coldwater, Mich., presided over the gathering of more than 100 members and guests.

First steps toward organization of the Central Michigan Chapter were taken last Jan. 30 when, at a meeting of about 30 interested participants, the advantages of organizing the 53 foundries in the Lansing, Jackson, Kalamazoo, Coldwater area were discussed. At a subsequent meeting, held Mar. 14, 41 central Michigan foundrymen voted unanimously to organize and to petition the national AFA board of directors for a chapter charter.

Temporary officers were named, as follows: Chairman, Douglas J. Strong; vice chairman, John Secor, Hill & Griffith Co., Niles; secretary-treasurer, Fitz Coghlin Jr., Albion Malleable Iron Co., Albion. Steering committee members were: W. E. Fisher, Reed Foundry & Machine Co., Kalamazoo; Erwin Doerschler, U. S. Foundry Corp., Kalamazoo; E. H. Schlepp, Riverside Foundry & Galvanizing Co., Kalamazoo; J. R. Granger, Calhoun Foundry Co., Homer; Orville Drum, Battle Creek Bread Wrapping Machine Co.; H. J. McCoy, Albion Malleable Iron Co.; Kenneth Buelow, Marshall Furnace Co.

With the group's organization well on its way, the first technical meeting was held in Marshall, Apr. 8, with 78 found-

(*Continued on page* 173)


Quantity
PRODUCTION
of
GREY IRON CASTINGS
ONE OF THE NATION'S
LARGEST AND MOST MODERN
PRODUCTION FOUNDRIES
ESTABLISHED 1866
THE WHELAND COMPANY
FOUNDRY DIVISION
MAIN OFFICE AND MANUFACTURING PLANTS
CHATTANOOGA 2, TENNESSEE

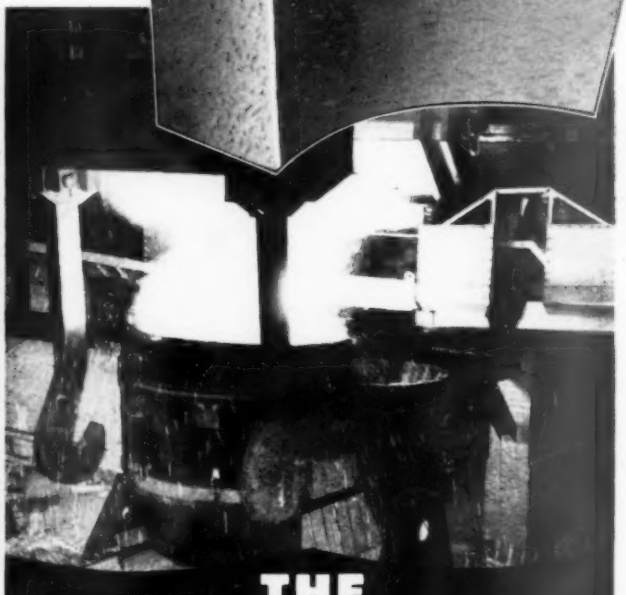
FURNACE LININGS GET LONGER LIFE WITH ROBINSON *Uniform* REFRACTORIES

YOU gain lower operating and maintenance costs when your furnaces are lined with Robinson's silica and fire clay brick.

Robinson silica and fire clay brick are manufactured from raw materials which are selected for their *uniformly high quality*. They combine the desired qualities of 1.) high softening point to withstand operating temperatures; 2.) resistance to spalling to provide for fluctuating temperatures, and 3.) density for resistance to slags and gases. These advantages make possible heat-after-heat of top-capacity furnace-output.

The technical research and control that is behind the manufacture of Robinson Refractories is your assurance of uniformity and highest quality in each and every shipment.

You can easily select from Robinson's extensive line of refractories materials by consulting the Robinson catalog or directing your inquiry to us. Our answers to inquiries are prompt and comprehensive. Write today for quick service or information on any Robinson product.



REFRACTORIES PRODUCTS: Silica and Fire Clay Brick, High Temperature Bonding Mortars, Castable Refractories, Acid-Proof Cement, Plastic Fire Brick, Insulating Fire Brick, Ground Fire Clays.

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THE ROBINSON CLAY PRODUCT CO.
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(*Continued from page* 172)

rymen present representing approximately 35 foundries of the area. Speaker at this meeting was Charles B. Schureman, Baroid Sales Division of National Lead Co., Chicago, who spoke on "Synthetic Molding Sand Problems and Solutions."

The enthusiastic turnout at the May 20 meeting and comments of the participants confirmed the sponsors' belief that the new chapter is the answer to a long need of the area's foundrymen for a permanent and active organization. At this meeting E. H. Schlepp, Riverside Foundry & Galvanizing Co., was appointed chairman of a committee to make plans for a summer outing to be held the latter part of August.

Technical speaker at the meeting was William B. McFerrin, Electro Metallurgical Co., Detroit, who spoke on the fundamentals of cupola operation. Mr. McFerrin covered the important phases of cupola practice, stressing the need for competent operators who thoroughly understand melting operations. Fitz Coghlin Jr. acted as technical chairman and led the question and answer period at the conclusion of the talk.—*Douglas J. Strong, Foundries Materials Co.*

New Jersey

A DIRECT method for reducing foundry costs was outlined by E. Norman Kagen, president, E. Norman Kagen & Co., consulting management engineers, New York, before the New Jersey Foundrymen's Association, Newark Athletic Club, Newark, N. J., May 26. By this method, he pointed out, an analysis of the portion of time which workers waste or spend inefficiently can be made relatively quickly and provides valuable information about steps which can be taken to improve efficiency. Approximately 80 members and guests were present.

An added feature was an address by Steward H. Jacobi, manager, Social Security Department, New Jersey State Chamber of Commerce, pertaining to sickness benefits, a matter of special importance to local foundrymen in view of bills likely to come up soon for consideration at a special session of the New Jersey state legislature.

Mr. Kagen pointed out that while there have been advances in casting methods, they have not kept pace with metal cutting and substitute material methods. Hence, foundries have arrived at the point where internal improvement must be carried on more vigorously. This can best be done, the speaker said, by checking efficiency on existing operations.

In his method a check is made of direct labor jobs, indirect labor jobs, machinery use and floor space use. Statistically controlled operations are used to measure the "work conditions" of as many as 100 operations in an analysis group. He referred to three "work conditions": (1) Adding Value—actually adding measureable work to the parts or the end product in work; (2) Making Ready—those production elements needed to get the parts into a position where value can be added and are inherent with the shop method; and (3) Idle Time—any action or inaction by machinery or labor which is neither adding value nor making ready.

The detailed breakdown of the three conditions for each work station, Mr. Kagen explained, is the true picture of productivity and must be measured by direct observation from the production floor.—*Ben K. Price.*

Quad City

TOP MANAGEMENT in the area was invited to a luncheon of Quad City Chapter of the AFA at Blackhawk Hotel, Davenport, Iowa, May 19, to meet Sheldon V. Wood, president, and William W. Maloney, secretary-treasurer, of the national AFA. Both Mr. Wood and Mr. Maloney spoke at the luncheon.

Over 100 members and guests celebrated National Officers' Night at the chapter's evening meeting at Fort Armstrong Hotel, Rock Island, Ill. In a talk at this meeting, Mr. Wood addressed his remarks mainly to the younger men, telling them about the romance of the foundry business. He warned management that it was their duty to make use of their younger men's talents as supervisors. He advised management to keep their good men moving up and not to get into a rut.

Mr. Maloney spoke of the business workings of AFA and of its relation to the foundry industry.

Chapter officers elected at the April meeting were installed during a short business session.

A sound movie taken at Ordnance Steel Foundry Co., Bettendorf, Iowa, during the war was shown.—*C. R. Marthens, Marthens Co.,*

Central Ohio

TECHNICAL discussions at the Apr. 21 meeting of Central Ohio Chapter of the AFA were held in two sections. Subject for the steel section was "Gases in Metals," which was discussed by Schuyler Herres and L. W. Eastwood, Battelle Memorial Institute. Dr. Eastwood introduced the subject by outlining some of the laws and principles governing the behavior of gases in metals. Following amplification of some of the principles involved, Mr. Herres illustrated the effects of gases in steel.

Tom Barlow, Battelle Memorial Institute, addressed the gray iron section on the subject of "Inoculation." Because of Mr. Barlow's familiarity with the subject, he was able to give numerous practical illustrations of the benefits derived through proper inoculation.

At Central Ohio Chapter's May 26 meeting, Pat Dwyer, THE FOUNDRY, spoke on "Heading and Gating." Mr. Dwyer discussed various methods of gating and risering castings—an important phase of foundry operations.

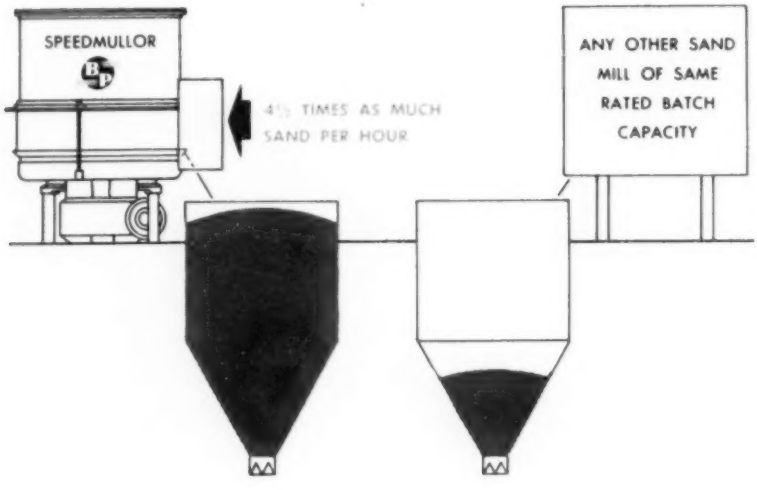
Officers for the coming year were elected at this meeting. They include: R. H. Frank, Bonney-Floyd Co., Colum-

(*Continued on page* 178)

QUAD CITY: New officers were installed by Quad City Chapter of the AFA at the chapter's regular meeting May 19. Shown left to right are: William W. Maloney, national AFA secretary; Sheldon V. Wood, national AFA president; Russell H. Swartz, incoming Quad City chairman; C. S. Humphrey, retiring chairman, and Ray Marthens, secretary-treasurer

FACTS

on sand mulling



S P E E D M

THE SPEEDMULLOR IS THE ONLY MULLOR THAT:

1. Mulls sand between rubber avoiding break down of sand grains
2. Guarantees positive turning of mullor wheels with proper pressure applied
3. Aerates the sand as it mulls
4. Removes fines to a controlled degree
5. Cools sand by the passing of air through it as it mulls
6. Thoroughly discharges the entire batch in 6 to 8 seconds

PERFORMANCE RECORDS PROVE THAT THE SPEEDMULLOR:

1. Mulls sand to its maximum physical properties 4½ times as fast as any other sand mullor
2. Cools sand—as it mulls—to within 10 degrees of room temperature in 1½ minute cycles
3. Thoroughly mulls sand at the lowest cost per pound of sand mulled, including maintenance

Small, medium or large foundry — there's a type and size of Speedmullor to meet your exact requirements. Speedmullors are available with or without skip hoist; air cooling; fines removal. They can be equipped for completely automatic operation, batch weighing, loading, mulling, cooling and discharging.

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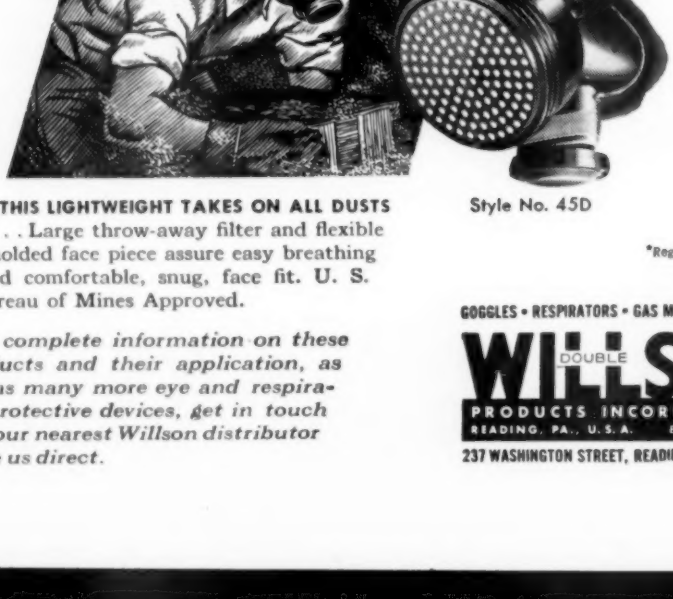
Add Comfort to Your Safety Program ...get WILLSON

Style F350

COMFORT IS IN THE SADDLE . . . With this broad saddle nose bridge, there's less fatigue in wearing these goggles over long periods of time in heavy duty operations. Super-Tough* lenses, of course.

Style No. 1

AN OUNCE AND A QUARTER OF PREVENTION . . . Lightweight, form fitting MONOGoggle can be worn all day with comfort. Tru-Hue green or clear plastic full vision interchangeable lens has high impact strength.



Style No. 45D

THIS LIGHTWEIGHT TAKES ON ALL DUSTS . . . Large throw-away filter and flexible molded face piece assure easy breathing and comfortable, snug, face fit. U. S. Bureau of Mines Approved.

For complete information on these products and their application, as well as many more eye and respiratory protective devices, get in touch with your nearest Willson distributor or write us direct.

*Reg. U. S. Pat. Off.

GOGGLES • RESPIRATORS • GAS MASKS • HELMETS

DOUBLE WILLSON PRODUCTS INCORPORATED

READING, PA., U. S. A. Established 1870

237 WASHINGTON STREET, READING, PA., U. S. A.

(*Continued from page* 175)

bus, O., chairman; Fred W. Fuller, National Engineering Co., Columbus, vice chairman; D. E. Krause, Battelle Memorial Institute, Columbus, secretary and William Hoffman, H. B. Salter Mfg. Co., Marysville, O., treasurer.

Directors for one year are: Norman J. Dunbeck, Eastern Clay Products Inc., Jackson, O.; Karol Whitlatch, Aetna Fire Brick Co., Oak Hill, O.; Harry Warsmith, Jeffrey Mfg. Co., Columbus, and William T. Bland, Commercial Steel Casting Co., Marion, O.

Directors for two years are: Ray E. Fisher, Bonney-Floyd Co., Columbus, and Walter L. Deutsch, Columbus Malleable Iron Co., Columbus.—*D. E. Krause, Battelle Memorial Institute.*

Metropolitan

CLOSE co-operation between patternmaker and foundry was urged in an address by L. F. Tucker, City Pattern & Foundry Co, Inc., South Bend, Ind., before members of the Metropolitan Chapter of the AFA, May 5, Essex House, Newark, N. J. Pointing out that a casting is no better than the pattern from which it is produced, he laid special emphasis on the matter of draft and shrinkage, and touched on many problems demanding a thorough understanding between the pattern and foundry shops, for best results.

Kenneth A. DeLonge, International Nickel Co., New York, recently vice chairman of the chapter, was elected chairman for the ensuing year, succeeding Harold L. Ullrich, Sacks-Barlow Foundries Inc., Newark. John Bukowski, Worthington Pump & Machinery Corp., Harrison, N. J., was elected vice chairman and J. F. Bauer, Hickman, Williams & Co., New York, and D. Polderman Jr., Whiting Corp., New York, were re-elected secretary and treasurer, respectively.

Newly elected directors are Dan W. Talbott, Cooper Alloy Foundry Co., Hillside, N. J.; J. S. Vanick, International Nickel Co., New York; W. S. Rose, Smith Oil & Refining Co., South Kearney, N. J.; R. A. Flinn, American Brake Shoe Co., Mahwah, N. J.; and R. D. Speirs, Wright Aeronautical Corp., Wood-Ridge, N. J.

In his talk Mr. Tucker outlined briefly the history of patternmaking and emphasized the influence of the automobile industry on development of precision patterns. This industry, he pointed out, had to have a good, inexpensive casting—and, incidentally, as the price of castings came dawn, the cost of patterns went up, especially during the early years.

Discussing draft and shrinkage, he suggested the advisability of checking shrink-

age with experimental castings, if at all feasible.

Illustrating his remarks with slides, the speaker also directed attention to the proper construction and design of core-boxes and core blowers. A lively discussion concluded the meeting—the last of the season.—*Ben K. Price.*

Reading

APPROXIMATELY 115 members and guests attend the regular monthly meeting of Reading Foundrymen's Association, May 20, in the Walnut Room, Berkshire Hotel, Reading, Pa.

Clyde A. Sanders, American Colloid Co., Chicago, spoke on "Foundry Sand Practice," illustrating his talk with slides. He said that the human variable is the biggest factor in the foundry industry, and that management must be able to control this variable in order to get good castings.

Prospective members introduced at the meeting were Donald Smith, Riverside Foundry, Wrightsville, Pa., Sam Brubaker, Brubaker Mfg. Co., Landesville, Pa.—*W. I. Cassidy, secretary.*

Philadelphia

PHILADELPHIA Chapter of the AFA held its last regular meeting of the season, May 9, at the Engineer's Club, Philadelphia. A. S. Wright, metallurgist, Hunt-Spiller Mfg. Corp., Boston, spoke on "Synthetic vs Natural Sand for Cast Iron."

He presented many practical observations in making castings of similar types in both natural and synthetic sands. George Bradshaw, Philadelphia Naval Shipyard, acted as technical chairman and was helpful in promoting general discussion.—*H. V. Witherington, H. W. Butterworth & Sons Co.*

Northern California

REGULAR monthly meeting of Northern California Chapter of the AFA was held at the Engineers' Club, San Francisco, April 11. W. E. Daugherty, refractory manager, L. H. Butcher Co., Los Angeles, representing Laclede-Christy Clay Products Co., St. Louis, spoke.

Mr. Daugherty explained that refractories must be designed to withstand heat, chemical reactions and mechanical forces. Depending on the application (acid, basic or neutral) the manufacturer has the choice of various materials to make his refractories. The products can be made to produce various results by changes in the manufacturing process which alter the refractory properties.

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Fully Illustrated 24-Page Book Printed in Four Colors

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A GUIDE TO SANITARY WASH FACILITIES

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Cover picture supplied by courtesy of the Studebaker Corp., in whose plant the photograph was taken. Using the fountain is a typical Studebaker employee family in this case, father John F. Marez and three sons. ..... COVER

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This new edition of the Bradley Group Washing Equipment Catalog will prove a handy reference for those interested in improved and more adequate washroom facilities.

Industrial users of Bradley Washfountains and Multi-Stall Showers have found that these modern, sanitary fixtures cut water and maintenance costs, reduce employee washing time—improve morale and goodwill.

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assist the manufacturer to improve his refractories by giving him all the details in regard to the practices involved and more accurate reports on the performance of the refractories themselves.

Following Mr. Daugherty's talk Robert G. Heim, Pacific Gas & Electric Co., presented a film prepared by his company and titled "The Miracle Flame." This technicolor film portrayed the story of natural gas, from its origin to the home and industrial consumer.—*Charles R. Marshall, publicity chairman.*

Central Illinois

GUEST speaker of the evening at the regular monthly meeting of Central Illinois Chapter of the AFA, May 5, at the Jefferson Hotel, Peoria, Ill., was B. C. Yearly, assistant manager, National Malleable & Steel Castings Co., Chicago, the subject being "Highlights of Malleable Practice."

Mr. Yearly compared the characteristics of gray iron, malleable iron and steel as to shrinkage, pouring temperatures, gates, risers, etc. This method of presentation proved very interesting to the foundrymen present who represent all branches of the industry.—*G. H. Rockwell, Caterpillar Tractor Co., Peoria, Ill.*

Cincinnati

APPROXIMATELY 110 members and guests attended the May 12 meeting of Cincinati District Chapter of the AFA at the Engineering Society headquarters. Speaker for the evening was Fred G. Sefing, development and research division, International Nickel Co. Mr. Sefing discussed the technical and practical aspects of cupola fuels and products of combustion.

The evening's program also included a film on the development of alloy steels and movies of the chapter's picnic last summer.—*E. F. Kindinger, secretary.*

New England

APPROXIMATELY 125 members and guests of the New England Foundrymen's Association heard M. F. Hulett, supervisor, permanent mold department, Elmira Foundry Co., Elmira, N. Y., speak at a regular association meeting May 14 at the Engineer's Club, Boston.

He spoke on the "Permanent Mold Process," and stated that permanent molds are usually made of cast iron. For general use they are about 1 in. thick and of open structure iron.

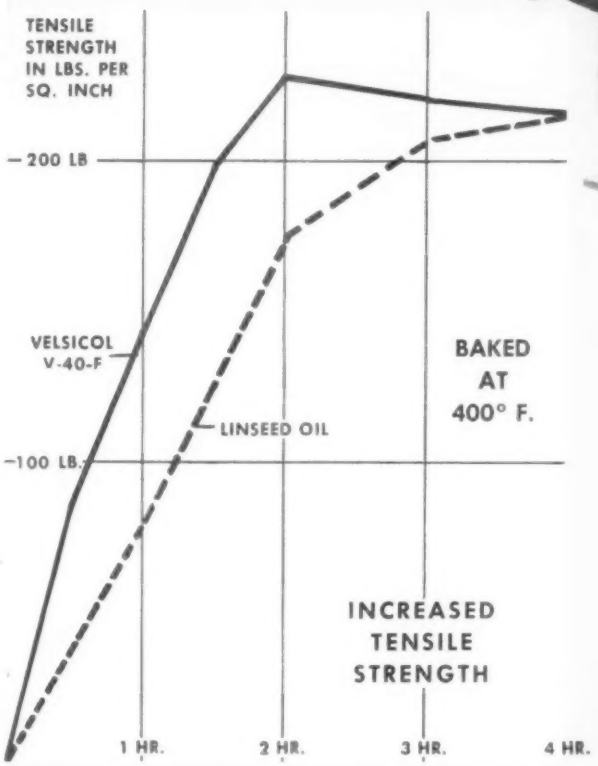
The molds are coated with a mixture of china clay, sodium silicate and water

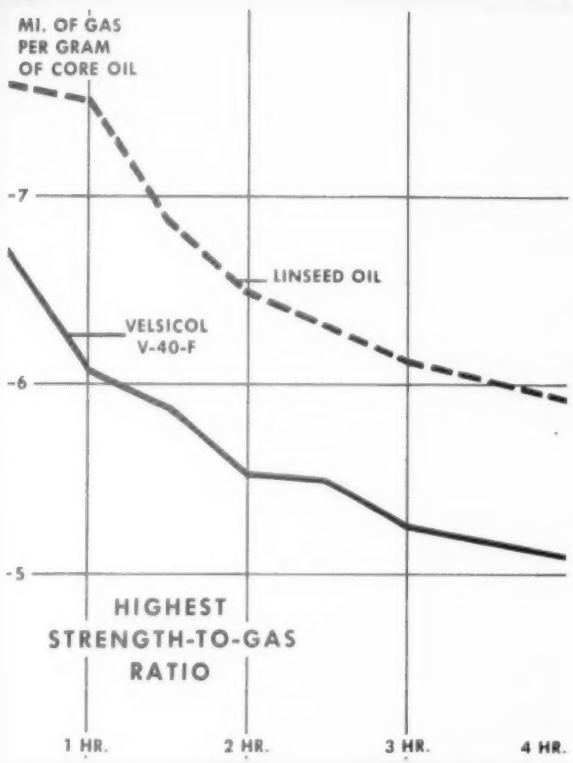
(*Concluded on page* 182)

VELSICOL V-40-F *Coresin* CORE OIL

combines

EFFICIENCY **ECONOMY**





These curves show the comparison in tensile strengths and baking speeds of Velsicol V-40F Coresin Core Oil and raw linseed oil at a baking temperature of 400°F. The sand mix is 50 mesh washed and dried rounded grain silica sand with 1% by weight of core oil and 2% moisture.

The curves were obtained using 50 mesh washed and dried silica testing sand with 1% oil and 2% moisture. Test cores were baked in a recirculating type laboratory oven and they developed comparable tensile strengths with each oil. Test specimens burned in their own atmosphere for 1 min. at 1900°.

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APPRENTICE WINNERS: Apprentice winners in the annual contest of Wisconsin Chapter, AFA, shown at the May 9 meeting in Milwaukee when the apprentices and district old timers were guests of the chapter. Photo by John Bing

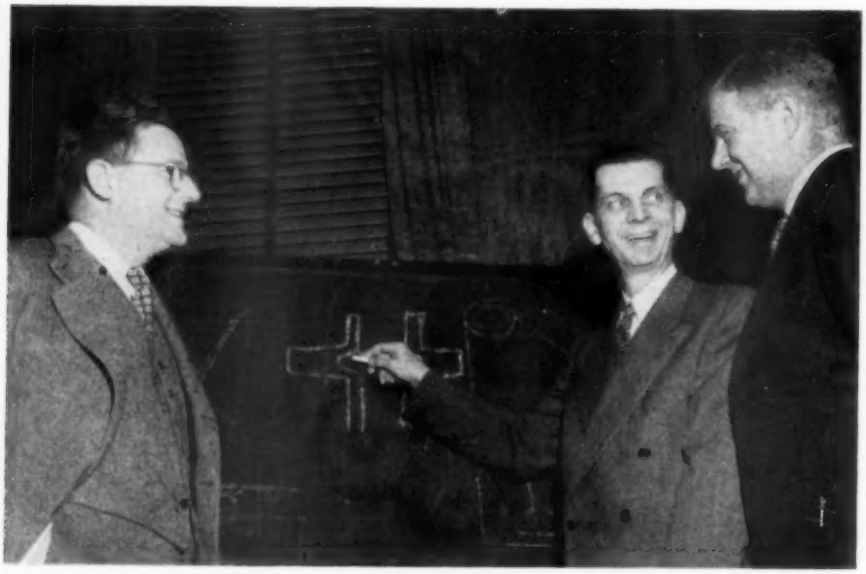
(*Concluded from page* 180)

—a mixture that is used principally for filling the mold voids. Some foundries use carbon or soot on the mold after every cast. The castings are produced with practically no chill and no porosity and are annealed at 1650 F.

Mr. Hulett stressed the necessity for good cupola practice with a well distributed charge and uniform material size. He recommended the tea-pot ladle because keeping slag at a minimum is important in producing good permanent mold castings. It is also desirable to keep the sulphur low.

He added that it is not necessary to preheat the molds before pouring, but usually the first two rounds of castings are discarded. He also pointed out the necessity of pre-smoking molds with an acetylene flame and stressed the fact that continuity of operating was an important factor. About 500-700 F was recommended as best mold temperature.

No gate on a permanent mold casting is thicker than 1/16-in. Additional feeding of the mold is accomplished by widening the gate. He concluded by saying that production of castings in lots under 1000 is not profitable when using the permanent mold process. *Merton A. Hosmer, Hunt-Spiller Mfg. Corp., Boston.*



CENTRAL ILLINOIS: B. C. Yearly, National Malleable & Steel Castings Co., guest speaker at the May 5 meeting of Central Illinois Chapter of the AFA, is shown illustrating a point on the blackboard. At left is Ed Roby and at right, Scott Roby, both of Peoria Malleable Castings Co., Peoria, Ill. Photo courtesy Caterpillar Tractor Co.

New Foundry Groups Supported by FEMA

The Foundry Equipment Manufacturers Association at a recent meeting of its board of directors took additional steps to place the support of equipment manufacturers behind newly established organizations which promise help to the foundry industry, according to an announcement by Arthur J. Tuscany, executive secretary.

The first deals with the Foundry Educational Foundation. Acting upon invitation extended by the foundation, the Foundry Equipment Manufacturers Association became a founder member. Designated as two trustees to serve with others on the foundation are Mr. Bruce L. Simpson, president of the National Engineering Co., Chicago, and Otto A. Pfaff, president of the association and president of the American Wheelabrator & Equipment Corp., Mishawaka, Ind.

The second organization in which FEMA is taking an active part is the National Castings Council. This overall group of all branches of the foundry industry is developing a constructive worthwhile program of assistance to all having an interest in the foundry industry. FEMA's representatives in the National Castings Council are Otto A. Pfaff, association president, and Thomas Kaveny Jr., president of the Herman Pneumatic Machine Co., Pittsburgh, and immediate past president of FEMA.

Mr. Tuscany states that "the board of directors of the Foundry Equipment Manufacturers Association, in line with the association's 25 year record of assistance to worthwhile foundry projects, is desirous of continuing this record, through giving all the help and assistance which the association and its members can reasonably render to the programs of the Foundry Educational Foundation and the National Castings Council."

Role of Machines Is Told in Booklet

What machine tools have done to increase the standard of living in the United States is told in a booklet entitled "Ten Great Inventions," published by National Tool Builders' Association, 10525 Carnegie Ave., Cleveland 6.

It tells the simple and direct story of the early days of the basic machines—machines which make men's work easier, their hours shorter, wages higher and prices lower. Machines create jobs, and the authors say that in past years people were not always able to see how much inventions would benefit them. And they add that, unfortunately, that is just as true today.

Customers — our best Salesmen

TELEPHONE ORILLIA 780

OTACO LIMITED

ORILLIA, ONTARIO

August
26th
1946

The Cleveland Flux Company,
1026 Main Avenue, N.W.,
Cleveland 13, Ohio.

Att. Mr. C. B. Cornell
Treasurer

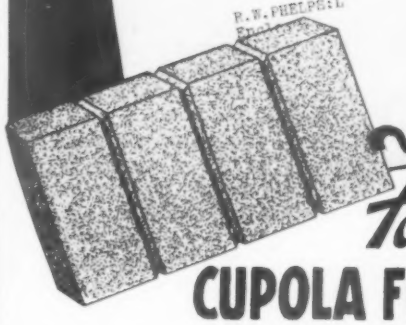
Gentlemen:-

I am attaching hereto our order for one ton or ton-and-a-half (depending upon the type of shipping you wish to effect) of your Cupola Flux and I would appreciate it if you would send this by return.

As I told you some time ago, our Metallurgist was skeptical so I frankly wrote a pretty stiff letter to eleven of the people which you referred to in your correspondence. I said that the information would be used confidentially when I wrote the letter and it will be used confidentially but you certainly would be surprised at the replies we got. Our initial order must indicate the type they were. Some of them were actually better salesmen than you are yourself.

Yours very truly,
OTACO LIMITED.

R.W.PHELPS:L



Famous CORNELL CUPOLA FLUX In Scored Brick Form

Cleanses molten metal, makes it hotter and more fluid. Castings come denser grained and stronger. Machining is easier. Cupolas are kept clean and slag more fluid. EXCLUSIVE SCORED BRICK FORM takes but a few seconds to use, promotes accurate measurement and prevents waste. *Write for Bulletin 46-B.*

The CLEVELAND FLUX Company

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Manufacturers of Iron, Brass and Aluminum Fluxes Since 1918

For more than 27 years....

We have been telling foundrymen how Famous Cornell Cupola Flux improves molten metal and it is gratifying to see how our customers back up our claims.

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FAMOUS CORNELL FLUXES
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Write for Bulletins

Famous CORNELL ALUMINUM FLUX

Produces clean, tough castings. No spongy or porous spots even when more scrap is used. Thinner yet stronger sections are poured. Castings take a higher polish. NO FUMES! Exclusive formula prevents obnoxious gases. Metal does not cling to dross.

Famous CORNELL BRASS FLUX

Makes metal pure and clean, even when dirtiest brass turnings or sweepings are used. Produces castings which withstand high pressure tests and take a beautiful finish. Saves considerable tin and other expensive metals. Crucible and furnace linings are preserved.

Famous CORNELL LADLE FLUX

Place a few ounces in bottom of ladle, then tap cupola. Metal is thoroughly cleansed, foreign impurities are easily skimmed off. Ladles are kept clean, there is less patching and increased ladle life. Metal temperatures are retained during transfer to molds.

Extended-Shaft Fan—Type CE

MOTOR LOCATION OUTSIDE AIRSTREAM MEANS LONGER LIFE...GREATER ACCESSIBILITY

Propellair extended-shaft fans provide the *extra features* necessary for successful handling of corrosive or abrasive high-temperature gases. Location of motor completely outside airstream gives *maximum* protection and *convenient* accessibility. Motor inspection and maintenance require no duct dismantling—no disruption of service.

Propellair extended-shaft fans give excellent circulation of air within drying ovens—fan operates within the oven, motor mounts outside.

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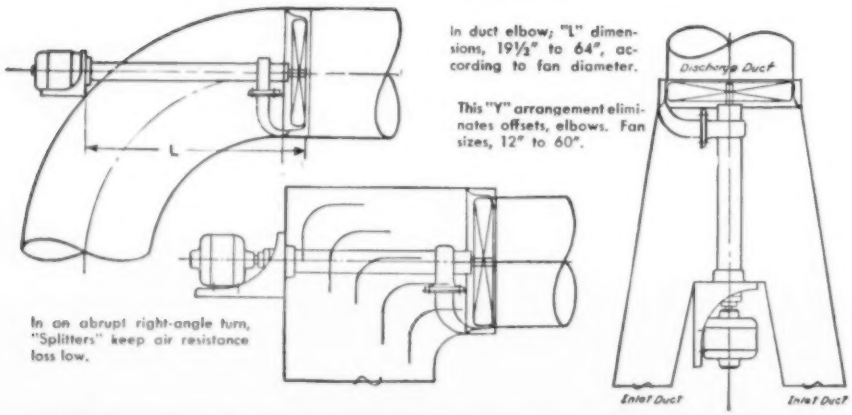
Use airfoil-design Propellairs for *real efficiency* in air movement. Blades actually *pull* more air than they *push—spread* work evenly over their entire surfaces, for high-velocity, high-volume, axial-flow output.

HEAVY-DUTY FANS FOR FOUNDRIES

Compact, functional-design Propellairs for foundry use have proved their dependability and economy under operating conditions of every kind. Types and sizes for every service—for mounting in ducts or stacks, in walls or windows, or upon floor stands, pedestals, or roofs. Write today for full information.

TYPICAL DUCT INSTALLATIONS


In duct elbow, "L" dimensions, 19½" to 64", according to fan diameter.
This "Y" arrangement eliminates offsets, elbows. Fan sizes, 12" to 60".
L
In an abrupt right-angle turn, "Splitters" keep air resistance loss low.
Discharge Duct
Inlet Duct
Inlet Duct

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OBITUARY

THOMAS S. HEMENWAY, 65, founder and president of the Metal & Alloy Specialties Co. Inc., Buffalo, and president of the Non-Ferrous Founders' Society for the administrative year 1946-47, died May 25. Mr. Hemenway, a native of Auburn, N. Y., was graduated from Purdue University in 1906, and went to Buffalo as engineer with the L. M. Ericsson Co., where he successively became sales engineer, sales manager and treasurer. He founded the

THOMAS S. HEMENWAY

Metal & Alloy Specialties Co. Inc., in 1916, and has served as its president since that time. Mr. Hemenway served on both the executive committee and the board of directors of the Non-Ferrous Founders' Society and was vice president and chairman of its membership committee before assuming the presidency.

* * *

Anthony Arth, 76, president, American Brass Mfg. Co., Cleveland, died May 21, at his home in that city. Mr. Arth, a native of Alsace-Lorraine, went to Cleveland in 1884. With his two brothers, Nicholas and Joseph, he organized the brass foundry in 1895, and following their deaths he continued to head the company, remaining active until about a year ago.

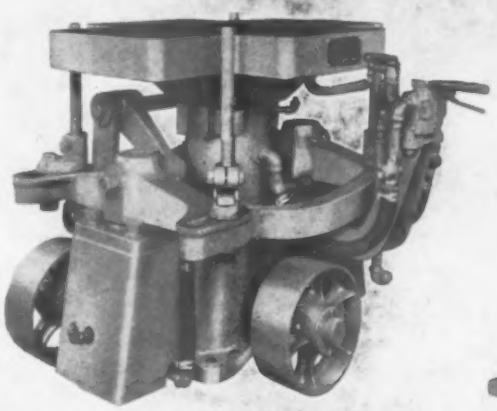
* * *

Frederick A. Preston, 63, since 1928 vice president, Poor & Co., Chicago, and chairman of its subsidiaries, the P. & M. Co. and Maintenance Equipment Co., both of Chicago, died June 8 in Lake Forest, Ill.

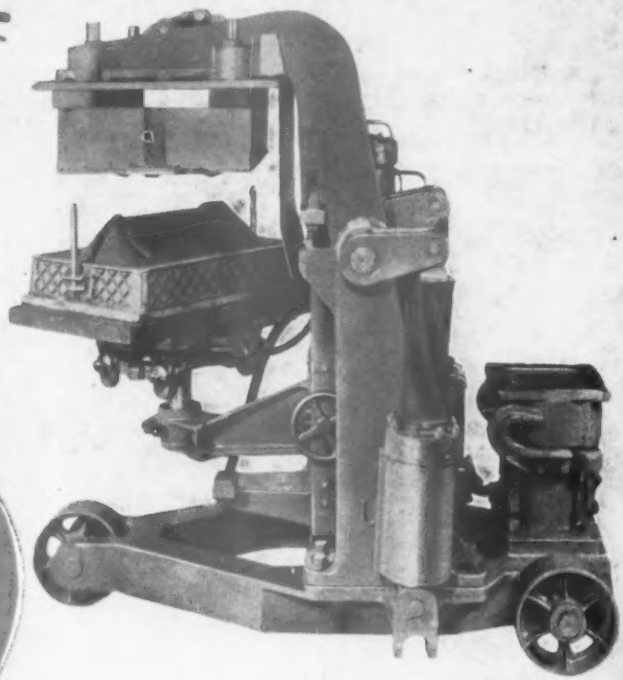
* * *

Charles E. Williams, 80, chairman and managing director of John Williams & Sons Ltd., Cardiff, Wales, died Apr. 14. Mr. Williams was educated at Cambridge and the University College of South Wales and Monmouthshire. He was the grandson of John Williams, founder

(*Concluded on page* 186)



No. 681-C
Portable Jolt Stripper



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Pace Setters

A COMPLETE LINE PROVEN IN SERVICE INCLUDING—

PLAIN AIR JOLTS
in 12 different sizes

JOLT SQUEEZERS
fast sturdy machines—3 sizes

JOLT STRIPPING PLATES
4 sizes ranging up to 16" draw

JOLT, SQUEEZE, STRIPPING PLATE AND PATTERN DRAWS
Popular for medium service —2 sizes

PORTABLE JOLT ROLL-OVER AND PATTERN DRAW
A heavy duty thoroughly dependable machine—portable

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Fast large capacity machines with roll-out conveyors—4 sizes

Write for fully descriptive catalog giving complete specifications.

● Speed up your production and keep competitive with Johnston & Jennings molding machines. The No. 681-C jolt stripper pictured above—furnished portable or stationary—features a valve-less, shock-less, jolt free from rebound, a positive draw, speed of which is variable to meet different conditions,—and complete enclosure of all working parts, thus assuring years of efficient trouble-free service.

The No. 612 Portable Jolt Roll-Over is designed specially for work requiring absolute accuracy in ramming and drawing. It is ideally used for making the intricate cores and molds required in aircraft and other precision industries. Use of two roll-over cylinders and oil dash pot control assures smooth uniform operation. "J & J" has just the machine you need.

Write or phone about immediate deliveries on these and other types of J & J machines

THE J & J JOHNSTON JENNINGS CO.

867 Addison Road • Cleveland 14, Ohio

IMPROVED UP-TO-THE-MINUTE MOLDING MACHINES FOR EVERY NEED

(*Concluded from page* 184)

of John Williams & Sons Ltd., and was a partner with his father, Lewis Williams, until 1899, when he became managing director. He served as president of the Institute of British Foundrymen in 1933 and his contributions were recognized by that organization in the establishment of the C. E. Williams Annual Lecture, given each year at the institute's convention. Mr. Williams was president of the Cardiff and District Ironfounders' Association for many years.

° ° °

Henry B. Mueller, 57, president and treasurer of the Spring City Pattern Works Inc., Waukesha, Wis., died May 31, at his home in that city. Mr. Mueller went to Waukesha from Milwaukee in 1919, and became a partner in the pattern works there at that time. Illness forced his retirement from active duties in 1942. He was a member of the Wisconsin Chapter of the AFA.

° ° °

Louis W. Kempf, 49, assistant director of research, Aluminum Co. of America, Cleveland, died June 14 in that city. Mr. Kempf was graduated from the University of Michigan in 1923 and joined the Aluminum company at Cleveland the following year as a research metallurgist. In 1930 he was placed in charge of metallurgical research at the Cleveland division of Aluminum Research Laboratories and was made assistant director of research in 1945. A nationally-recognized authority on aluminum alloys and their processing, Mr. Kempf last year was elected chairman of the Institute of Metals division of the AIME.

° ° °

Ralph L. Fox Jr., 26, associated with Naval Research Laboratory, Washington, was killed in the June 14 crash of an airliner near Leesburg, Va. Graduated from Penn College, in 1943 with a degree in metallurgical engineering, Mr. Fox was commissioned a lieutenant (jg) in the Navy and was stationed at the Naval Research Laboratory where he engaged in nonferrous metal research work specializing in copper-base alloy casting investigations. Following his discharge from the Navy last year he continued with the laboratory in a civilian capacity.

° ° °

Charles E. O'Brien, 42, factory controller and assistant to the president, the Grabler Mfg. Co., Cleveland, died May 28, at his home in that city. Mr. O'Brien became associated with the company at the age of 13, completing his education at night high school and law classes.

° ° °

Dean S. Hopping, 57, president, the Dayton Oil Co., Dayton, O., died June 5, at his home in that city following an illness of several weeks. Mr. Hopping, a native of Cincinnati, went to Dayton as a young man and founded the oil company 20 years ago.

° ° °

Samuel A. Whitehouse, 77, head of the former Isagon Aluminum Foundry, Chicago, and many years ago superintendent of the gray iron foundry, Hawthorne Works, Western Electric Co. Inc., Chicago, died May 24 in that city.

° ° °

Elmer R. Gilbert, 54, president, the Freeman Supply Co., Toledo, O., died there May 14, following a year's illness. Mr. Gilbert had been associated with the company for 30 years, serving as president for the last 24 years.

Chinese Make Thin Iron Castings

FIRST in many forms of activity, the Chinese probably were the first to practice iron founding, one of the oldest in the long list of accomplishments that serve as milestones in the long, long trail of civilization. The art has been developed to a high degree of perfection in some respects, but from a utilitarian standpoint has lagged far behind production and standards set up by the occidental nations. A typical example is the cast iron food bowl in universal use in Chinese homes. The bowls vary in size depending upon the size of the family. They not only serve as vessels in which the food is cooked, but also as dishes from which the food is eaten. From a labor saving, simple and economical standpoint, the program is not without merit.

For iron castings the bowls are exceedingly thin. Metal thickness in the 12-in. diameter bowl shown in the illustration is only 1/32-in., or about the thickness of a thin dime. The bowls are made in semipermanent molds in an inverted position and the metal is poured into a single small sprue above the center.

The bowl shown in the illustration was shipped from China to an official of the Hamilton Foundry & Machine Co., Hamilton, O., by Ping-Kao Han, a young engineer associated with the Kung Ta Engineering & Trading Co., Shanghai, China. Recently this engineer with wide experience in the construction and operation of Chinese foundries, spent several months on special assignment from his government in various plants in the Cincinnati area. During his stay he addressed a meeting of the Cincinnati Chapter of the American Foundrymen's Association.

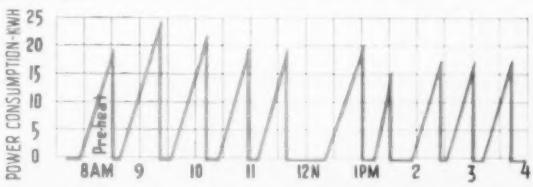
While visiting the plant of the Hamilton Foundry & Machine Co., he was shown many castings 1/10-in., and less in thickness. To Mr. Han these castings were relatively heavy. To dispel the skepticism of members of the foundry staff, he promised on his return to China to send a sample of real thin castings as made in his native land. Through the courtesy and generosity of the Hamilton Foundry & Machine Co., the bowl has been added to the collection of rare and interesting castings maintained in the office of THE FOUNDRY, Cleveland.

Analysis of the pot showed: Total carbon 3.20 per cent, silicon 2.06 per cent, sulphur 0.126 per cent, phosphorous 0.55 per cent, manganese 0.45 per cent.

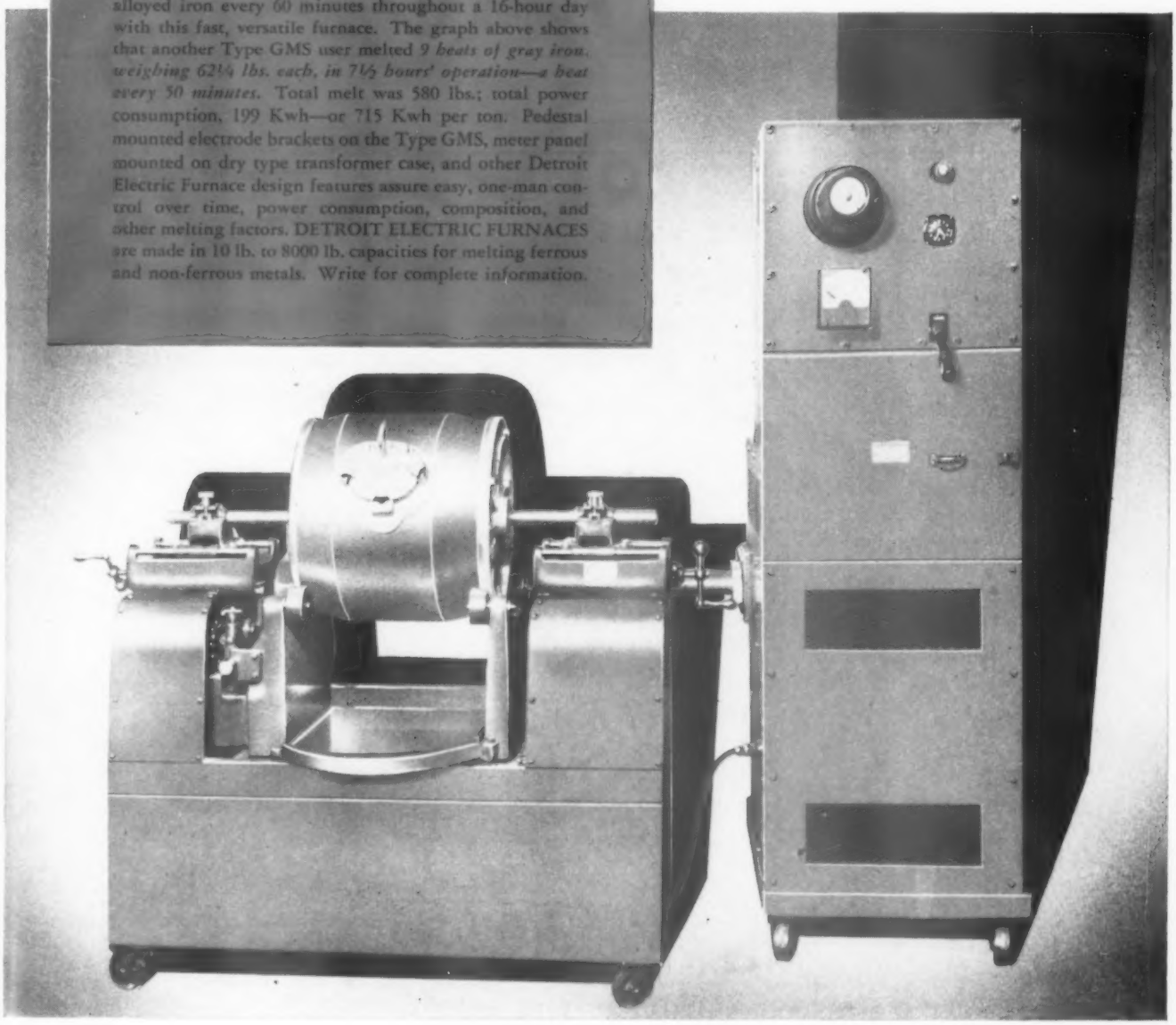
SURE FIRE TIMING IN METAL MELTING

Here's the ideal unit for running test heats and for limited production of special alloys—the Type GMS, 60 lb. capacity DETROIT ROCKING ELECTRIC FURNACE. *It melts capacity heats of iron or steel in 45 to 60 minutes; bronze or copper in 25 to 30 minutes; and Monel metal or other high nickel alloys in 30 to 40 minutes.* A manufacturer of automotive valves melts a 65-lb. heat of highly alloyed iron every 60 minutes throughout a 16-hour day with this fast, versatile furnace. The graph above shows that another Type GMS user melted *9 heats of gray iron, weighing 62¼ lbs. each, in 7½ hours' operation—a heat every 50 minutes.* Total melt was 580 lbs.; total power consumption, 199 Kwh—or 715 Kwh per ton. Pedestal mounted electrode brackets on the Type GMS, meter panel mounted on dry type transformer case, and other Detroit Electric Furnace design features assure easy, one-man control over time, power consumption, composition, and other melting factors. DETROIT ELECTRIC FURNACES are made in 10 lb. to 8000 lb. capacities for melting ferrous and non-ferrous metals. Write for complete information.

Daily Operating Record, Type GMS, 30 Kw., 60 lb., Detroit Rocking Electric Furnace, Melting Grey Iron.



Summary: Hours Operation, 7½; Heats, 9; Wt. per Heat, 62¼ lbs.; Total Metal Melted, 580 lbs.; Kwh Total, 199; Kwh per Ton, 715.

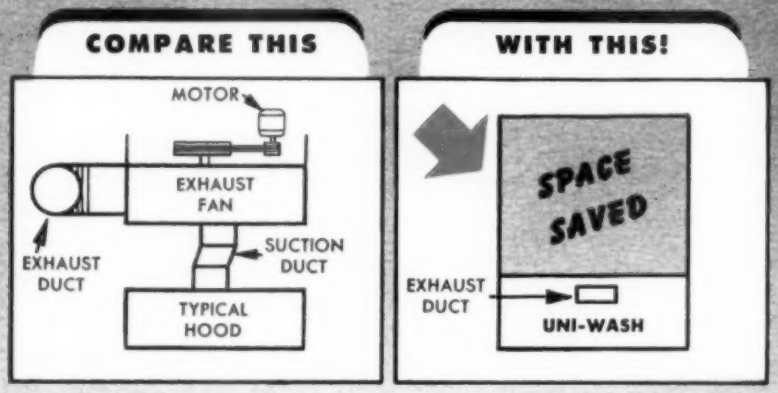


DETROIT ELECTRIC FURNACES

DETROIT ELECTRIC FURNACE DIVISION • KUHLMAN ELECTRIC COMPANY • BAY CITY, MICHIGAN

The UNI-WASH SHAKE-OUT BOOTH

OCCUPIES UP TO 75% LESS SPACE



THESE UNITS ARE SAME CAPACITY— DRAWN TO SAME SCALE

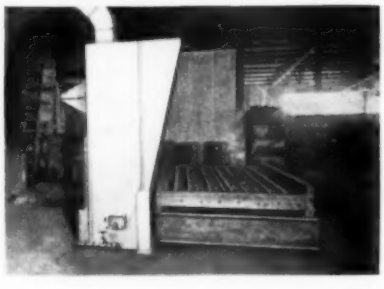
The floor plans above illustrate the space-saving design of the Uni-Wash Shake-Out Booth as compared with shake-out dust collectors of other makes. The Uni-Wash Shake-Out Booth collects, water-washes and drys, then exhausts dust laden air *within one compact unit.* No overhead equipment platforms to install and maintain, no suction ducts to install, clean or interfere with operations in the foundry . . . compact, complete, packaged dust collection.

Other Benefits

- Delivered 90% pre-assembled—factory tested prior to shipment. Connection of water and electrical services and discharge duct only installation operations necessary.
- 90% installation time and cost eliminated.
- 5 standard sizes—5000, 7500, 10,000, 12,500 and 15,000 CFM—used individually or in combination.
- Conveyor removes sludge automatically . . . reduced maintenance.
- Long, low cost service . . . only one moving part.
- Lower initial cost than any other system of comparable capacity.

Illustration at the right shows the neat, compact installation of the Uni-Wash Shake-Out Booth in a large foundry.

Send for Illustrated Catalog



Established 1912

NEWCOMB-DETROIT COMPANY

5741 Russell Street • Detroit 11, Michigan

AFA Approves Two New Chapters

Two new chapters of the American Foundrymen's Association—British Columbia and Central Michigan, numbers 37 and 38, respectively—have been approved by association directors.

Third Canadian chapter of the AFA, the British Columbia group will serve the entire province with headquarters at Vancouver. Request for its establishment was signed by 80 individuals representing 40 organizations.

Norman Terry, secretary-treasurer, Canadian Sumner Iron Works Ltd., Vancouver, heads the organizational committee. Thomas Cowden, manager, Wm. McPhail & Sons (Canada) Ltd., Vancouver, is vice chairman and Lovick P. Young, metallurgist, A-1 Steel & Iron Foundry Ltd., Vancouver, is secretary-treasurer.

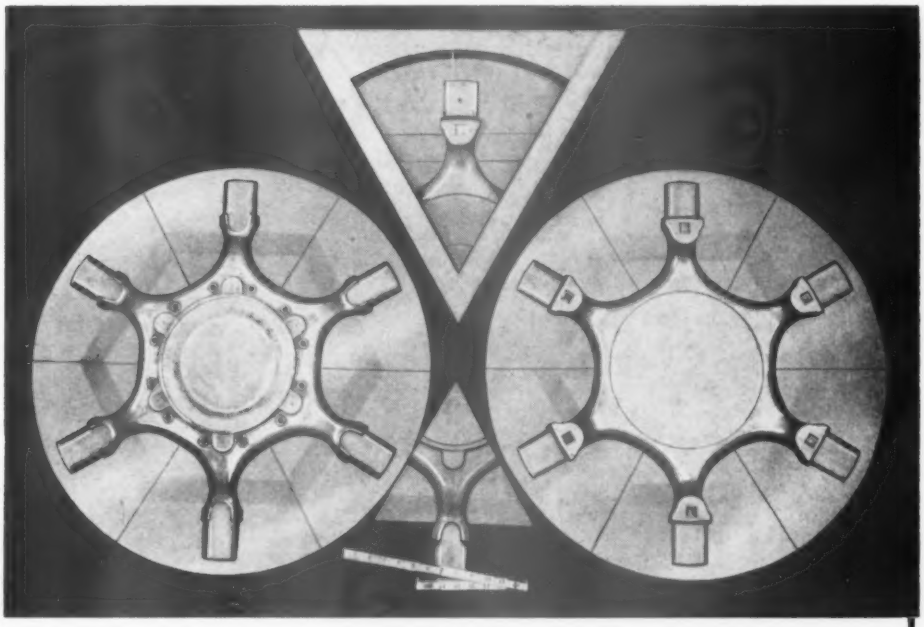
Included on the committee are: William M. Armstrong, assistant professor of mining and metallurgy, University of British Columbia; Fred Bay, superintendent, Vivian Engine Works Ltd.; James A. Dickson, owner, Dickson Foundry Co.; Fred E. Done, superintendent, Reliance Foundry Co. Ltd.; James S. Graham, assistant manager, Mainland Foundry Ltd.; John M. Hughes, metallurgist, Vancouver Engineering Works Ltd.; Howard A. Sturrock, managing director, Associated Foundry Ltd. and Harry J. Turney, manager, Westland Iron & Steel Foundries Ltd., all of Vancouver.

Chapter status for the Central Michigan group was requested by 66 individuals representing 24 firms in 12 towns. Centering around Marshall, the chapter will have a territory extending north to Lansing, east to Jackson, west to Kalamazoo, south to Coldwater, Hillsdale and the state line.

Douglas J. Strong, president, Foundries Materials Co., Coldwater, is organizing committee chairman. John Secor, Hill & Griffith Co. sales representative, Niles, is vice chairman and Fitz Coghlin Jr., metallurgist, Albion Malleable Iron Co., Albion, secretary-treasurer.

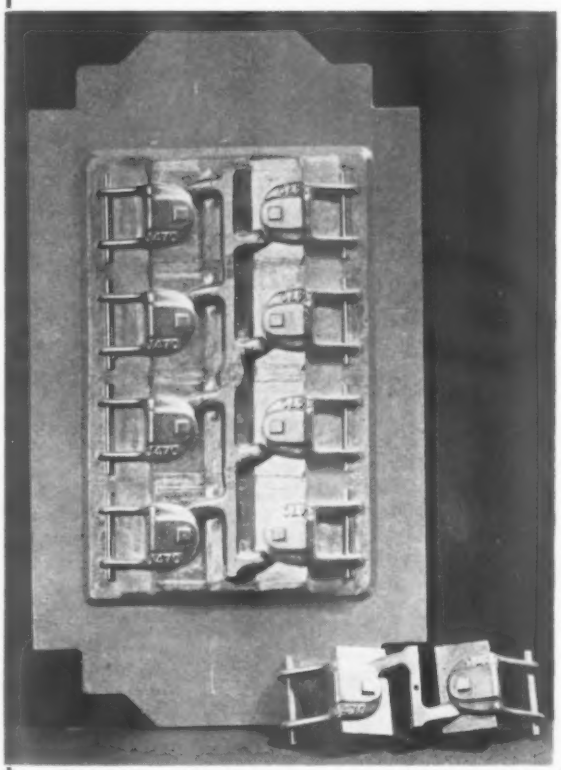
Committee members include Kenneth Buelow, foundry superintendent, Marshall Furnace Co., Marshall; Erwin Doerschler, superintendent, U. S. Foundry Corp., Kalamazoo; Orville Drumm, foundry manager, Battle Creek Breadwrapping Machine Co., Battle Creek; William E. Fisher, general manager, Reed Foundry & Machine Co., Kalmazoo; John R. Granger, manager, Calhoun Foundry Co., Homer; H. J. McCoy, superintendent, Albion Malleable Iron Co.; Edward H. Schlepp, foundry superintendent, and L. H. Stryker, Riverside Foundry & Galvanizing Co., Kalamazoo.

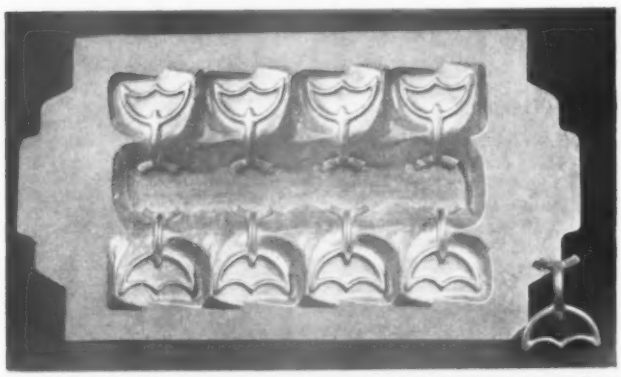
Illustration at right shows cope and drag equipment for truck wheel, made from one spoke (1–6) of wheel. Photograph by courtesy of Erie Malleable Iron Company.



PRESSURE CAST MATCHPLATES AND COPE AND DRAG PLATES INCREASE PRODUCTION AND CUT YOUR COST

Only one master pattern does it! From it we make you single or multiple pattern matchplates, casting them under pressure in plaster molds. Why not find out exactly how much we can save you by this method, or by furnishing cope and drag plates which likewise jump production and lower your costs? Write us for quotations now, while the matter is fresh in your mind.





These matchplates were made from single-gated (*left*) and master patterns (*right*), respectively.

PLASTER PROCESS CASTINGS COMPANY

6922 Carnegie Avenue — Cleveland 3, Ohio

(Affiliate: Toledo Matchplate Company, Toledo 2, Ohio)

Pressure-Cast MATCHPLATES
COPE and DRAG PLATES

PROFIT BY OUR MANY YEARS OF EXPERIENCE

The adventures of BILL

By PAT DWYER

Drawings by RICHEY

ASK any man between the ages of 16 and 66 how much he remembers of Caesar's *Commentaries* on Gallic war, and the chances are that he will admit the only tag end that sticks in his mind like the burdock on a cow's tail, is the statement that all Gaul is divided into three parts. Just to prove that he is not as dumb as he looks, or looks as dumb as he is, he will add brightly that it is a pity Bro. Caesar can't take a kind of a post gander around the circuit now. He would find plenty of reasons for revising his famous statement. He would have to stick another sheet of papyrus in the typewriter and point out that modern Gaul, sometimes laughingly referred to as La Belle F-r-r-aunce, is divided into more parts than a restaurant pie.

In this connection it is interesting to note that the late Mr. Caesar did not have a flock of war correspondents under foot and cluttering up the works. The *Commentaries*, a series of dispatches to the high hats in Rome, were written by himself, J. C. in person. Whether this course of procedure was prompted by a scarcity of skilled war correspondents, or more probably because Caesar reposed just that degree of confidence in war correspondents that generals in all ages have reposed in war correspondents—or any other person—a degree indicated by a large letter O, is a point upon which the gifted author has failed to comment.

This oversight also deprives us of the pleasure of learning the general's nickname. It is simply inconceivable that among the thousands of men who served more or less proudly under the conquering eagles, there was not a genius to invent a happy, intimate and descriptive moniker for the man in supreme authority. Soldiers from time immemorial have been drilled, and regimented and disciplined and pushed around, as the saying goes, from hell to breakfast, but one priceless gift they never have lost and that is the ability to condense their opinions, likes and dislikes into one or two salty words. In public life Caesar the general was known as Julius Gaius Caesar, a citizen, a patrician of the great Roman empire, but around campfires and bivouacs of the far flung legions it is a safe bet to guess he was better known as Old Blood-an'-Guts or Hell-on-Wheels.

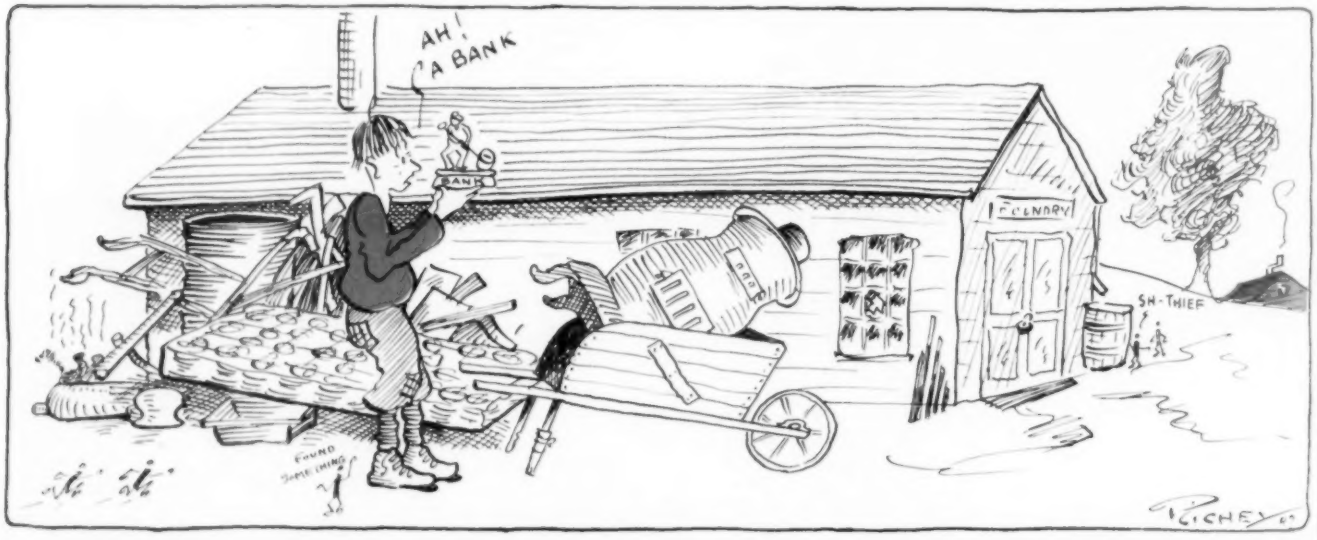
If you and they have the time and the opportunity, you might try your hand at putting on a little quiz program with another miscellaneous group. Ask each one in turn what he, she or it knows about Francois Villon, delightful vagabond, eccentric poetic genius, tatterdemalion mendicant and intermittent jailbird of the 15th century, knocking out literary masterpieces in the shivery winter air of a Paris garret, by the flickering light of a tallow candle stump, stolen from his reverend uncle's altar.

If in your crude Americanese you pronounce the name, "Villen," the first contestant will say, "What was the guy's name, again? So many villians in the country, a fella can't keep track of 'em." Then he tells his pet story of a sanctimonious crook who reamed every one in Blatsville, the story teller's home town, the year '87 or '88. He is quite sure you remember the year of the big snow. Either that or he will say he never heard of the bird. If you try to give the name a French twist, or what you fondly imagine is a French twist, V-long with a long *I*, he will say, "O. A Chink, hey? I never read none of that stuff painted with a brush up and down and from right to left like a laundry ticket. So long!"

If your patience holds out, a second member of the group may admit to a dim recollection of something he read as a boy, about a scaly French character in the middle ages who lived in a sewer, head man of the gang they call the Apaches, robbed friends, relatives, strangers, churches, hen coops and garbage cans and in between times wrote some verses about a bunch of ladies who got lost in a snow storm or something. Pretty drivelly stuff, if you want his really candid opinion. Something like the moaning and groaning tripe on the average radio program. While battling bravely through the second year in the tenth grade, he had to memorize some of that snow storm stuff, but all that kind of thing was far away and long ago. All water over the dam, or under the bridge, or maybe down the rat hole. Gone and forgotten.

Inevitably, the third cast into a group

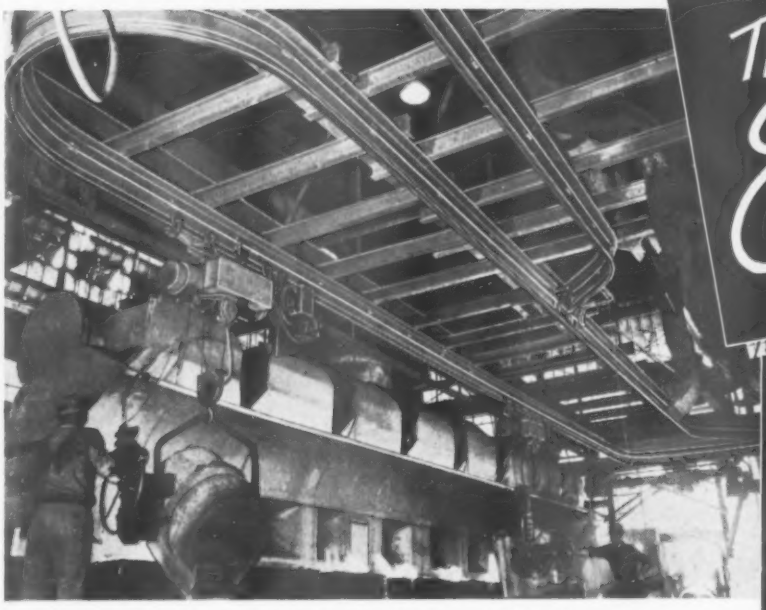
(*Continued on page* 192)



The new and proud owner of a stove and a bank would not change places with Monte Cristo

HANDLING METAL

The Easy Way!



Finger-tip pouring with MonoTractor and Hoist Unit.

Simple MonoRail loop speeds distribution from cupola

Free moving cranes cover large pouring areas.

Electric hoists insure accurate pouring position.

From cupola to flask, hot metal moves easily on American MonoRail. Trolley wheels, equipped with precision bearings, roll on hard track flanges reducing the effort required to handle heavy ladles.

Any MonoRail installation will speed up production, lower costs, reduce accidents and fatigue, and release skilled hands for more profitable use.

With thousands of installations to draw from, American MonoRail Engineers are well qualified to offer solutions involving overhead handling equipment. This service is offered without obligation.

THE AMERICAN MONORAIL COMPANY

13104 ATHENS AVENUE • CLEVELAND 7, OHIO

or ask

YOUR LOCAL FOUNDRY SUPPLY HOUSE

for

2-DAY DELIVERY on Combs Riddles.

TYPE V, illustrated above, is priced at $210.00 complete, and is one of several available types.

COMBS Gyratory Foundry Riddles and equipment are distributed by Foundry Supply Houses throughout the United States and Canada . . . ask your supply house for details on our wide range of sizes.

Great Western Manufacturing Company

LEAVENWORTH, KANSAS

(*Continued from page* 190)

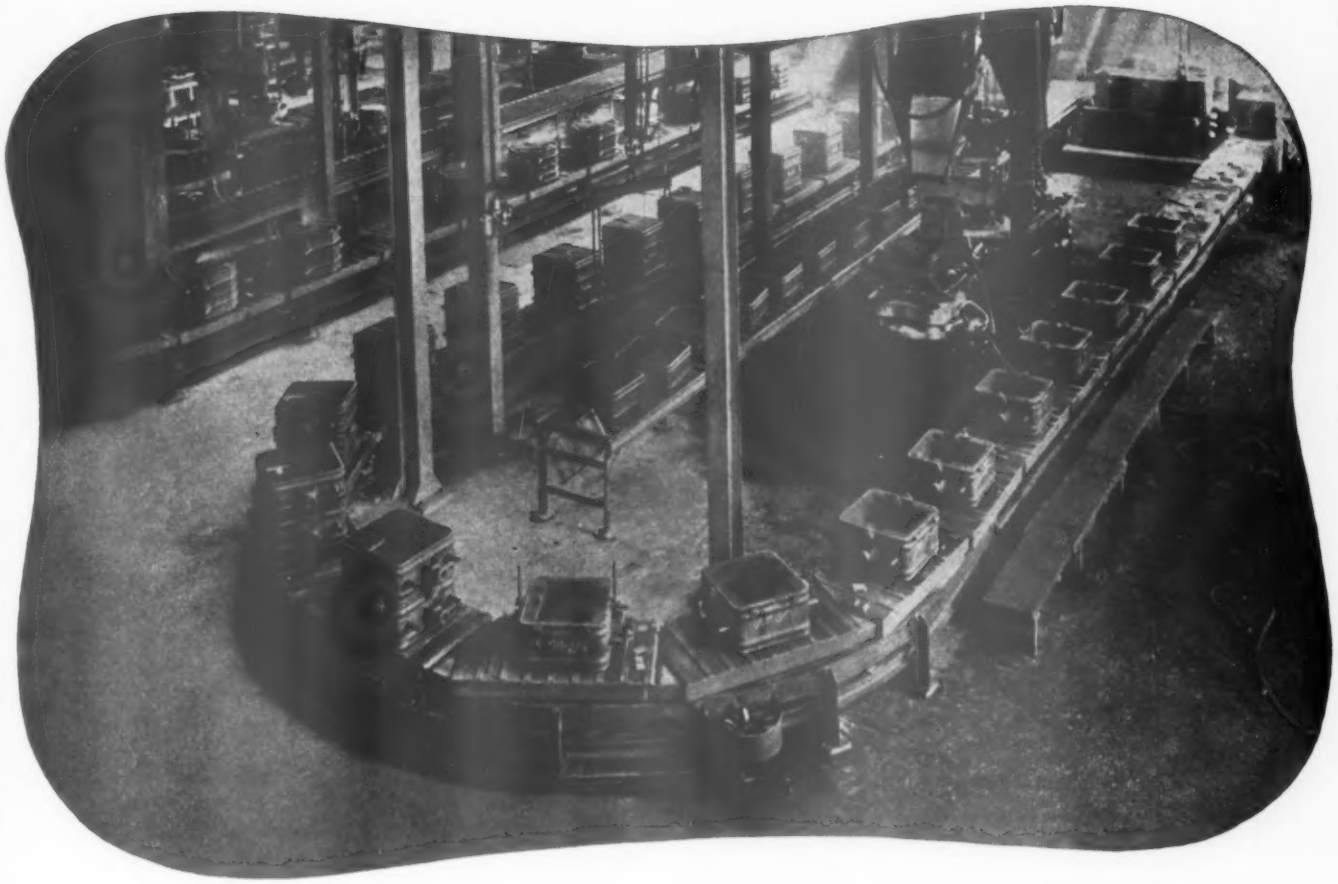
of this kind will bring to the surface at least one retired lady school teacher who has survived many a weary hour of driving a flock of dumb little bunnies through the dark labyrinth and over the high jumps, hurdles and pitfalls of parsing and analysis. However, she does not escape unscathed. Constant and prolonged exercise of absolute authority has developed the piercing eye, the corrugated forehead, the dominant nose and chin and the thin, determined lips. Her militant faith in herself is equal to that of Louis XIV who reminded the judge *"I* am the State." Close and intimate association with successive waves of embryo intellects over a period of many years would build up a feeling of mental superiority in the blessed and humble St. Francis of Assisi himself. You have only yourself to blame if she spills the entire poem in your lap.

Such a question for a hot day

"Now, say in what land is she, fair Flora of Rome? Again, where may Hypparchia be, with Thais in grace germane? Where's Echo, than mortal slain fairer, a voice that goes o'er river and meer of rain? But where are the last year's snows? And where is that learned Heloise, whom Abelard loved in vain, losing at St. Denys manhood in grievous pain? And the Queen who did ordain for Buridan his repose, cast in a sack in the Seine, but where are the last year's snows? The White Queen fair to see, whose song was a siren's strain! Beatrix, Berthe, Alys, Herembourges who held le Mayne? Joan, the good maid of Lorraine, burned by the English foes. Virgin! Where are they ta'en? And where are the last year's snows?"

Thus we come by easy stages to Allen's Alley and the *Query du Jour*, or not to put too fine a point upon it, the question of the day: What do you know, or rather

(*Continued on page* 194)



These Curves Have Angles Too

Traveling in an endless loop past the molding stations, the pouring zone, along the cooling run to the shakeout, and back to the molders again, Bartlett-Snow continuous mold conveyors enable foundry owners and plant managers to get a maximum of both quantity and quality from their plants. Individually engineered to your own particular plant requirements, Bartlett-Snow foundry equipment reduces the number of defectives, increases output, reduces costs, minimizes labor difficulties by giving the workers a larger take home pay, easier. And smoother, more continuous production returns increased profits, larger dividends to you. Can we send you more detailed information?

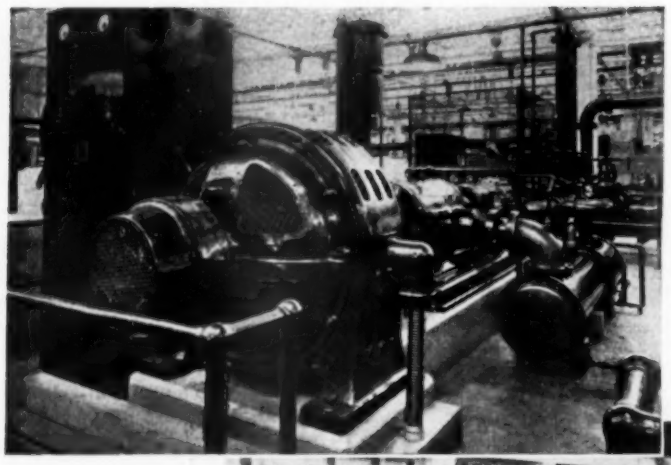
Bulletin No. 91 sent on request

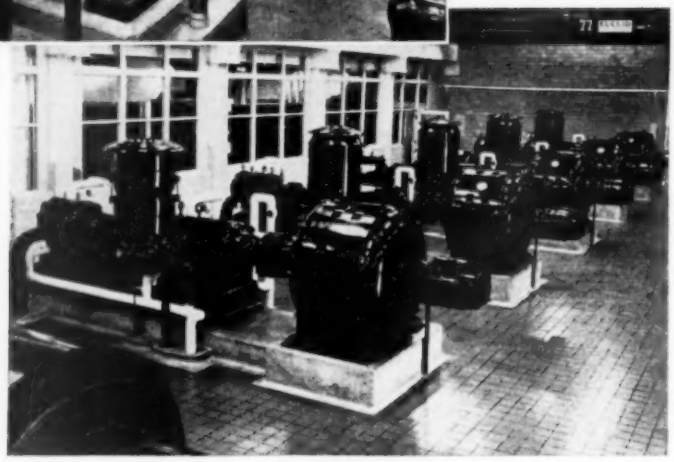
THE C. O. BARTLETT & SNOW CO.

6201 HARVARD AVENUE • CLEVELAND 5, OHIO

ENGINEERING REPRESENTATIVES IN THE PRINCIPAL CITIES

FOUNDRY SAND, MOLD AND CASTINGS HANDLING





43

Fuller Rotary Compressors Purchased Since 1939

Starting in 1939, one of the largest manufacturing companies of the country purchased its first Fuller Rotary Compressor. Satisfactory performance of the initial installation has led to many additional orders. Up to the present time, 43 Fuller Rotaries have been purchased and installed by the customer in its many plants throughout the country.

The majority of machines installed in these plants are of the two-stage type, operating at 125-lb. pressure, such as illustrated above.

These machines will serve for many years to come because, they're built for long, continous service . . . few working parts, none to adjust. In addition, due to design and construction, a Fuller Rotary maintains its original capacity for the life of the machine.

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FULLER-KINYON, FULLER-FLUXO AND THE AIRVEYOR CONVEYING SYSTEMS . . ROTARY FEEDERS AND DISCHARGE GATES . . ROTARY AIR COMPRESSORS AND VACUUM PUMPS . . AIR QUENCHING INCLINED GRATE COOLERS . . . DRY PULVERIZED MATERIAL COOLER . . . AERATION UNITS . . . MATERIAL LEVEL INDICATORS . . MOTION SAFETY SWITCH . . SLURRY VALVES . . SAMPLERS

C-143

(*Continued from page* 192)

what can you remember about the cast iron toy banks, still and mechanical, found in nearly every household before and after the turn of the century?

"Don't ask me," Bill protested when I laid the question on his mental door step. "With the exception of specimens cherished by collectors here and there, the former nation-wide supply appears to have disappeared. They have gone to join the buffalo, the passenger pigeon, the great auk and the dodo, hoop skirts, bustles, wigs and fancy waistcoats, and the surrey with a fringe around the top. I did not stay in school long enough to get acquainted with your two thieving friends, Big Thief who stole whole countries from their rightful owners, and Little Thief who stole altar candles and anything else on which he could lay his nimble and, no doubt, grimy paws. Therefore I have no opinion to offer on these two more or less interesting characters. However, at one time when I was a boy, I owned a cast iron toy bank. Well, perhaps *owned* is not exactly the right word. I had it in my possession for a time, but since I stole it in the first place, a stickler for accuracy might be tempted to claim that I was quite a bit off the reservation in the loose statement of ownership."

"Come, come," I said. "Make up your mind. Either you owned the thing, or you did not own it."

"Well," said Bill, "I'll tell you. I owned this ornament in the sense that I had it in my possession, and that is a convincing form of argument, in constant use since the first hairy ancestor threw a covetous eye on a neighbor's belongings. If the argument for thousands of years has been good enough for those who sit in high places, I suppose it should be good enough for me. Still-an-all, as my old uncle Malachi used to say, I think it is only fair that you should know all the circumstances."

"So, I am supposed to pop my eyes and ask in a hushed whisper if you stole the bank from under the very nose of a savage bulldog who guarded it night and day. After you had it filled with pennies, and in retribution for your horrid crime, the heavy bank one day fell on your foot and practically ruined three toes. You have the bank at home now, if I wish to see it."

"Three strikes and you are o-u-t, OUT! I did not steal it from a bulldog. I did not fill it with pennies. In fact, I never dropped a single penny into it. You have been in the water with me often enough to see that all my toes are present, accounted for, and in perfect working order.

"By drawing lots in regular ship-shape fashion, I was elected by the Raw Head and Bloody Bones Lodge No. 13, Brethren of The Coast, to visit the scrap pile back

(*Continued on page* 196)

Question? Answer!

¶ *What bonding clay gives this rare combination of five big advantages?*

Only Black Hills Bentonite! It assures you of:

1. Greater resilience than any other bonding clay. *Advantage:* less danger of molds breaking at corners or along edges. Less danger of rattails and buckles.

2. Higher dry strength than any other clay. *Advantage:* no cuts or washes.

3. Very high green strength. *Advantage:* less material needed; also, less dead clay left in sand.

4. High permeability. *Advantage:* protection against blows.

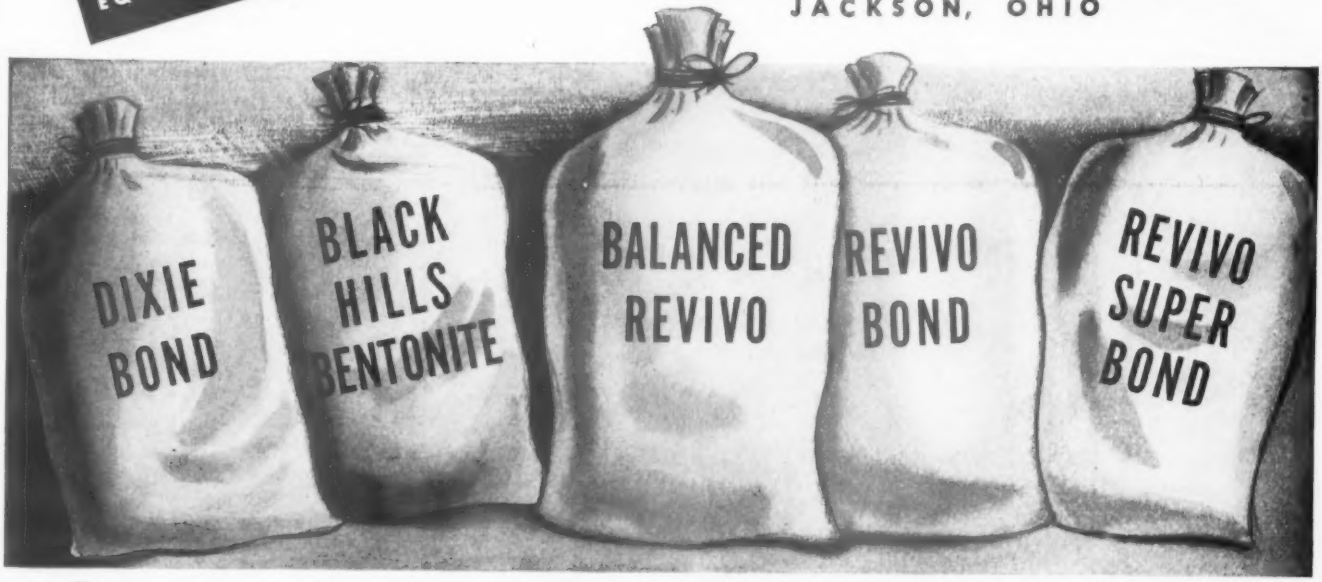
5. A combination of high hot strength and high permeability unequalled by any other bonding clay or combination of clays.

★ ★ ★

¶ Black Hills Bentonite is one of five distinctive bonding clays recommended singly or in combination by ECP engineers to fit different foundry requirements. Authoritative bulletins on request.

EASTERN CLAY PRODUCTS, INC.
JACKSON, OHIO

Remember
NO ONE BONDING CLAY WILL DO ALL JOBS EQUALLY WELL!



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DIXIE BOND • BLACK HILLS BENTONITE • REVIVO BOND • REVIVO SUPER BOND • BALANCED REVIVO

All TYPES OF BONDING CLAYS

A Foundry Sand Service Based Upon Practical Research

Reduce Scrap Loss in Pressure Castings-

with

Milwaukee

Thread Stem Chaplets

The design of these chaplets insures complete, thorough fusing in any casting . . . a vital factor in reducing scrap loss due to "leakers."

This *complete fusion* is assured by the many sharp, coarse rings . . . having a larger diameter than the stem itself . . . which run from head-to-head on Double Head Chaplets. The use of Milwaukee Thread Stem Chaplets permits a heavier stem than would otherwise be possible. This results in the added benefit of a well secured core as well as a pressure-tight casting.

Milwaukee Thread Stem Chaplets are used extensively in all types of castings subject to gas, steam, oil or water pressure where leakage means "scrap." They are made of low-carbon steel, coated for rust-proofing . . . in any lengths, stem diameters and head sizes. They cost no more than ordinary chaplets. Pure aluminum Thread Stem Chaplets are available in small sizes.

Manufacturers of the Milwaukee-Tessmer Sprue Cutter for Non-Ferrous Castings.

Milwaukee

CHAPLET AND MANUFACTURING CO.

1025 S. 40th STREET • MILWAUKEE 4, WIS.

A 5201-2/3

(*Continued from page* 194)

of the local foundry and lift a stove for installation in our stronghold in a patch of woods near the river bank. Everything was open in those days and no person paid any attention to stray prowlers. The stove had been spotted a few days before by a scout who was allergic to formal education and who spent most of his time out where the wind blows free. Like that fella in the song who constantly was afraid some one was going to fence him in. In the evening after all shop and office employees had gone home, I loaded the stove in a wheelbarrow and conveyed it to the pirate retreat.

"Looking back now I find it almost impossible to believe that at the age of 12 I was a positively hardened little criminal. The only redeeming feature in the situation is that through a form of mental blindness that affects small boys, none of the gang seemed to realize that we were guilty of a crime and that we stood in imminent danger of being stuffed into the calaboose or the pokey for the remainder of our natural lives. In fact, the realization did not come fully until many years afterward when I had occasion to say a few words on the subject to one of my sons.

"So far as I can remember in my own pirate days the ethics of the situation never came up for discussion. Briefly and in elementary fashion we reasoned that (a) We needed a stove. (b) A suitable stove was in the scrap pile. (c) Scrap had no value. (d) What are we waiting for?"

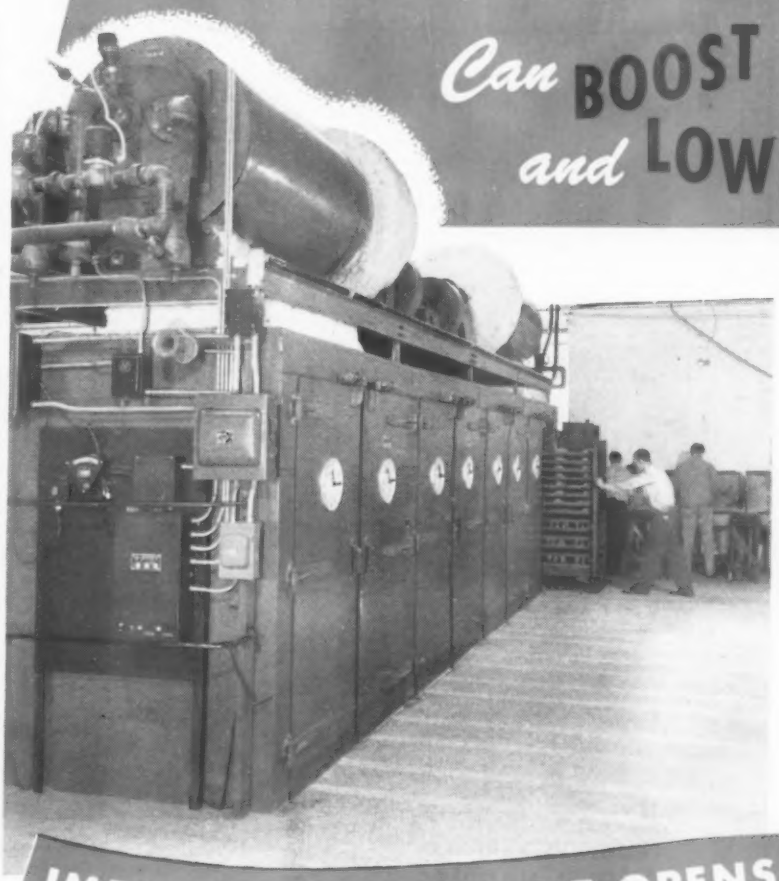
"You will pardon me," I said, "but I was under the impression that my question was on the subject of toy banks. I do not remember that I expressed even the minutest iota of curiosity in regard to scrap stoves or the peculiar ethics of young hellions who steal them."

"Keep your few wisps of hair on. I was coming to that. While tramping through the scrap pile I noticed this bank I was telling you about. I took it along on general principles. At that time I had no pennies to put into it, but youth is naturally optimistic and you never can tell what might happen. Then something did happen that aroused a suspicion for the first time that there was some kind of dirty work at the crossroads. I would do well to walk softly, keep a sharp lookout fore and aft and throw a glance now and again to lee and windward. Definitely I decided not to deposit any hard earned pennies in my new bank.

"One night at a council meeting of R. H. & B. B. Local 13 B. O. T. C., a worthy member, alias Long John Silver Jr., introduced a resolution gravely censuring one of the leading citizens for one of the meanest and most dastardly acts ever perpetrated in our fair city. This leading

(*Concluded on page* 200)

How These FOUNDRY OVENS Can BOOST Your Production and LOWER Your Costs



- **Ample Heat and Air Flow** directed over entire core surface area gives faster, more uniform core baking.
- **Large and Small Cores Baked** at the same time. This 2-compartment oven provides new flexibility of core baking, produces assorted size cores at the same time when production schedules require it.
- **No Burnt Cores . . . No Green Cores.** Regardless of core sizes the Despatch Oven is designed to bake evenly to specifications—to give top quality cores with no rejects due to imperfect baking.
- **Lower Fuel Costs.** New engineering features to suit foundry needs plus high efficiency heaters give you the benefit of every BTU in your fuel.

IMPROVED EQUIPMENT OPENS NEW FIELDS TO AN OLD SKILL

6 Reasons Why Foundrymen Like DESPATCH OVENS

Speedy Baking with unique high volume airflow system.

Easy Loading systems to fit any foundry layout.

Saves Space with streamlined, compact design.

Uniform Heat to assure even baking of every core.

Low Fuel Cost with very high-efficiency heating.

Automatic control of heat; needs no watching.

New requirements upon the old craftsmen of the foundry have been met by new techniques and new methods for processing sand castings. Each new method requires more precise and more speedy equipment. For instance, new binders require more accurate heat control, new production speeds require new methods for handling. DESPATCH Foundry Ovens have been designed to fulfill needs created by the technical advancements in the industry . . . to provide the old skills with the equipment necessary to meet the new production requirements of an expanding industry.

DESPATCH OVEN COMPANY

Minneapolis Office:
619 S. E. 8th St.

Chicago Office:
221 No. LaSalle St.

Offices in All Principal Cities

DESPATCH OVEN COMPANY

WRITE TODAY FOR BULLETIN J-31

"All Federal Products A

FEDERAL S

FEDERAL'S LOWE SIFTER

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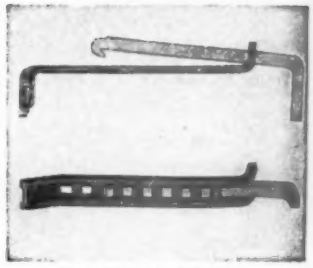

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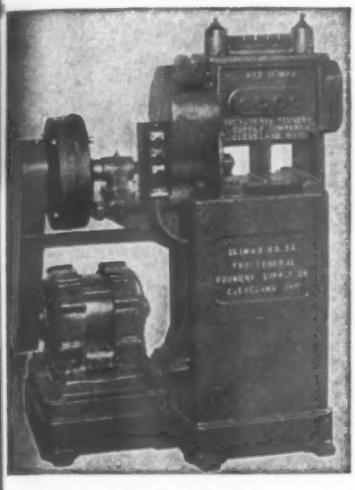

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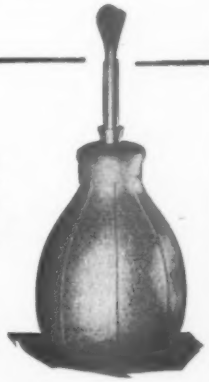

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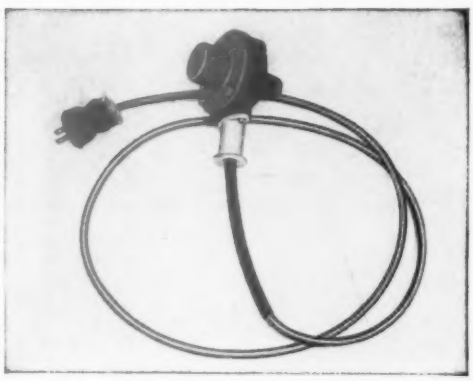

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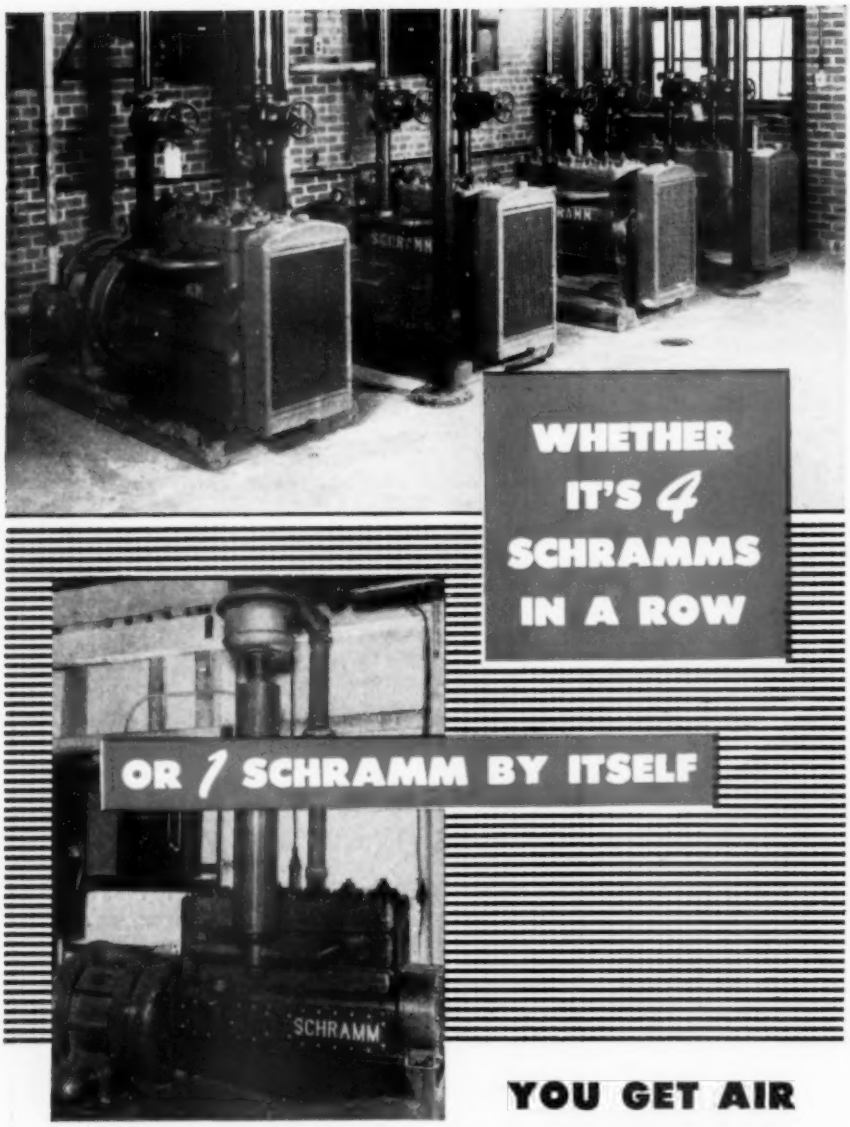

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(*Concluded from page* 196)

citizen, known as Squire Smith, or simply as The Squire, popularly was believed to have more money than any other person in the town. And the reason he had so much money was that he knew how to manipulate the stuff so that it stayed with him. In this respect he differed radically from members of our group who fanatically held to the belief that all money in hand or in prospect should be spent as soon as possible.

"The specific charge against the Squire was that every night he bribed each of his children with two bright copper pennies to go to bed supperless. The money was placed in a toy bank. When the children were asleep, the old boy cracked the crib and retrieved and repouched the pennies. Well, forewarned is forearmed. The following day I carried my bank down to the foundry and tossed it back on the scrap pile."

GASES CAUSING UNSOUNDNESS IN COPPER-BASE ALLOYS

(*Continued from page* 71)

increasing temperature, and, at 2192 F, 0.125 per cent of the pure, normally molecular hydrogen is in the atomic form.[23] Molecular hydrogen, however, is not normally present in the atmosphere surrounding the melt. Even if it were, it probably would not be a marked source of atomic hydrogen unless it were permitted to oxidize first to form moisture. Moisture, however, is a very potent source of atomic hydrogen because the moisture will oxidize most metals readily, even more so than oxygen. In this oxidation process, atomic hydrogen is produced according to the following reaction:

$$zM + n\,H_2O \rightleftharpoons M_zO_n + 2n\,H$$

where M refers to any metal such as copper, zinc, tin, etc., z and n refer to the number of molecules required to balance the equation.

The oxide formed by this reaction may remain on the surface in the form of a dross, or a portion of the oxide may be absorbed or dissolved by the melt in the form of the oxide, or this dissolved oxide may be partially dissociated in the melt into its constituents, i.e., the metal and atomic oxygen. Because of the large amounts of strongly reducing elements in copper-base alloys, the solubility of the hydrogen is apt to be considerably higher than that of the oxygen or oxide. It is to be expected, therefore, that only a portion of the oxygen or oxide will be absorbed or dissolved by the melt. The maximum amount of oxide or oxygen which can be dissolved by the melt will be determined by the principle described

(*Continued on page* 202)

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(*Continued from page* 200)

above and illustrated by Fig. 5 (THE FOUNDRY, June, 1947).

There is very good evidence that the principal source of atomic hydrogen is moisture,[29] and that this moisture is decomposed by the metal to form atomic hydrogen as previously described. This atomic hydrogen is absorbed onto the melt surface. The adsorption of the hydrogen on the surface of the melt is the first step in its solution into the melt.[20] The hydrogen, during the adsorption process, attaches itself to the surface of the melt in a layer probably not more than one atom thick. The principles of gas adsorption on metal surfaces have been described in detail,[20] and summarized.[15] The atoms of the hydrogen pass this surface to the interior of the metal by the process of diffusion. In liquid metals, of course, this diffusion is accelerated by mechanical movement of the liquid body in a stirring action. The hydrogen thus held in the metal as individual atoms or molecules of a hydride, partially or completely dissociated, is in solution in the metal. This hydrogen in solution is not generally harmful, until it is precipitated by either Type 1 or Type 2 gas evolution.

Hydrogen may also escape from the melt by the reserve of the foregoing process,[15] if the hydrogen content in the melt is in excess of the equilibrium amount of atomic hydrogen adsorbed on the melt surface, which amount of adsorbed hydrogen would necessarily be in equilibrium with its supply of atomic hydrogen or moisture in the surrounding atmosphere. The escape of hydrogen by this process is akin to evaporation.

Also, hydrogen can escape from the melt by the formation of finite gas bubbles, the condition from which has been described.[15, 21] Such gas cavities will be round, if they form, and are trapped in a nearly complete liquid, or angular, if shaped by bounding solid crystals or dendrites, in a partially solidified melt.

Oxygen as a Cause of Unsoundness—

At one time, oxidation was considered to be the cause of the unsoundness which has been defined in this series of papers as microporosity. This point of view has now been abandoned, and the unsoundness is recognized as small cavities, or voids, in the casting.[22, 32, 34, 35] It is now generally held that oxygen does not cause unsoundness in copper-base alloys; that is to say, oxygen by itself. If oxygen alone were in the melt, it would probably precipitate out, when the melt solidified, as an oxide of one of the metals present. However, it has already been noted that oxygen will exist simultaneously in the melt with strongly re-

(*Continued on page* 204)

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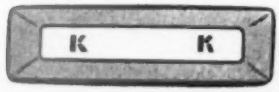

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(*Continued from page* 202)

ducing elements, and that the oxygen may be in equilibrium with these elements at the time the melt is ready to be poured.

When the melt solidifies, however, this equilibrium is destroyed and both the oxygen and other gas or gas-forming elements are concentrated in the remaining liquid. Reactions A, B, C, or D (described in the first article) may then proceed to the right, causing unsoundness in the casting. It is necessary, therefore, in commercial practice to remove the oxygen, as far as possible, by the addition of a deoxidizer before pouring the melt into the mold cavity. This is generally done by the addition of a copper-phosphorus alloy containing 10 or 15 per cent phosphorus. The necessity for this deoxidizing operation has been described in the second article.

Add Minimum Amount

It is logical that the oxidizing treatment or oxidizing condition to which the melt was exposed will be more effective, and the subsequent treatment of the metal with a deoxidizer more necessary, the less reducing the alloy content to the melt. Thus, a copper-tin alloy subjected to oxidizing conditions would have a low hydrogen content corresponding to the high possible oxygen content of this composition. Subsequent deoxidation would place both the oxygen and hydrogen contents low enough to avoid steam formation when the melt solidified.

On the other hand, if the melt contained a high percentage of phosphorus or several per cent zinc, the maximum possible oxygen content would be very much lower than the previous example cited, and the hydrogen content would be much higher. Since the metal bath is already strongly reducing, the addition of phosphorus would be expected to reduce the oxygen content to a less extent than in the copper-tin alloy just cited, leaving the oxygen and hydrogen contents nearer their equilibrium value ready to react when the equilibrium concentration of the reactants was exceeded during the process of solidification.

It may be concluded, therefore, that oxygen by itself does not produce unsoundness. Oxygen in combination with hydrogen or other gas or gas-forming materials may produce unsoundness by Type 2 gas evolution. This possibility can be at least partially alleviated by a deoxidation treatment consisting of the addition of a strongly reducing element, such as phosphorus. Such a deoxidation treatment would be expected to be the most beneficial in melts containing a minimum of strongly reducing elements, and the least effective in melts which

(*Continued on page* 206)

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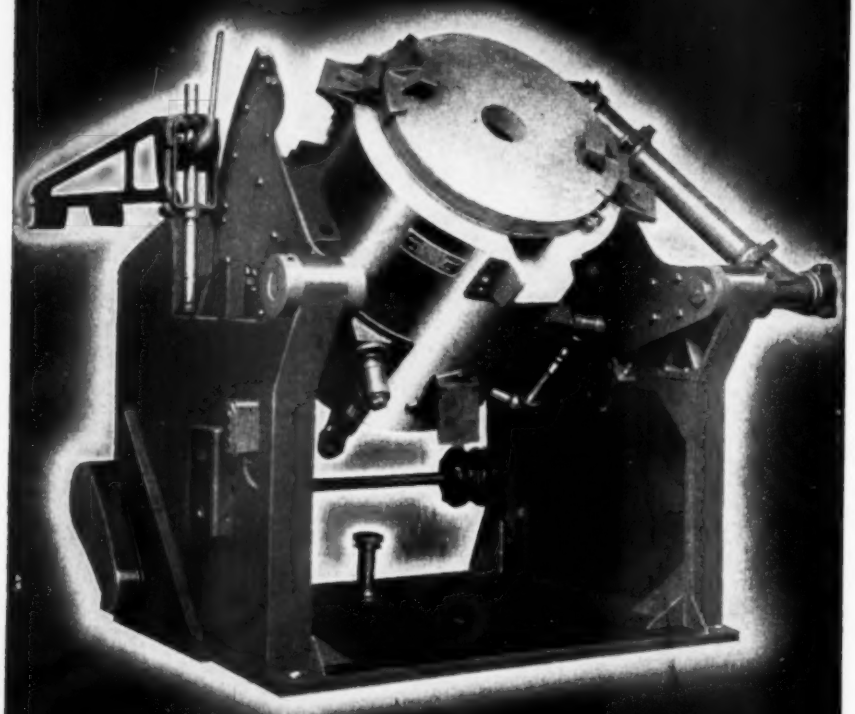

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(*Continued from page* 204)

contained a considerable amount of strongly reducing alloying elements.[14]

Carbon and its Oxides as Causes of Unsoundness—It has been reported that the solubility of carbon in molten copper was of the order of 0.003 per cent. Floe and Chipman[7] indicated that the solubility of carbon in copper was of the order of 0.0004 per cent. While there are no data on the solubility of carbon in any of the copper-base alloys, with the possible exception of nickel-silver alloys,[29] there certainly is a good possibility of slight solubility. However, to cause unsoundness, large amounts of carbon are not necessary. Reference to Table I shows that if only 0.000039 per cent of carbon, one tenth of the reported solubility, were to react with 0.000052 per cent of oxygen, a volume of CO or carbon monoxide at 1900 F equivalent to 3.0 per cent of the volume of the metal would be formed. Approximately twice the amount of oxygen would be required to form the same volume of carbon dioxide at 1900 F.

Reaction Is Relatively Harmless

It should be noted here, however, that such a reaction would be relatively harmless if the solubility of carbon monoxide or carbon dioxide in the metal at this temperature were greater than the amount of these gases evolved by Reaction C or D, or if there were a substantial solubility of these two gases and the melt were not previously saturated with them before Reaction C or D started. It must be concluded that, if Reaction C or D can produce unsoundness in copper-base alloys, the solubility of carbon monoxide and carbon dioxide must be very low indeed. But, there is a good possibility that dissolved carbon in copper-base alloy melts produces unsoundness by Type 2 gas evolution according to Reaction C, previously noted.

It is well known that pouring copper-base alloy melts over red hot charcoal will cause unsoundness in the castings. This could be caused by carbon absorption but, because of the marked adsorptive power of charcoal, it is possible that other gases may be involved even though the charcoal is at a red heat, or higher. There is also some evidence that, when melting copper-base alloys in crucibles containing graphite, less sound castings are produced than when melts are prepared in similar furnaces not lined with a graphite-containing material.[2, 37] Some metallurgists[22, 7] regard dissolved carbon as one source of unsoundness in copper-base alloys, and it must be concluded that Type 2 evolution, according to Reaction C, is a likely cause of accentuated microporosity.

(*Continued on page* 208)

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(*Continued from page 206*)

If carbon monoxide were soluble in the copper-base alloy melt, it would be necessary to have sufficient oxygen present to produce carbon dioxide, and, assuming that the latter were insoluble, carbon monoxide dissolved in the melt would produce Type 2 gas evolution according to Reaction D. In this event, it would be necessary to oxidize both the carbon, if any were present in the melt, and the carbon monoxide to carbon dioxide before a harmful effect would be produced. There is no unanimity of opinion regarding the solubility of either carbon monoxide or carbon dioxide. Some investigators[12, 17] claim there is a slight solubility of carbon monoxide in bronze melts and that it is harmful,[32] while others say there is no solubility.[7]

It should be noted here, however, that, if the presence of carbon monoxide in the furnace atmosphere results in less-sound castings, this is not proof, contrary to some claims,[32] that carbon monoxide is dissolved in the melt, or that it is causing the trouble. The presence of a large proportion of carbon monoxide in the furnace atmosphere would indicate a slightly reducing atmosphere, resulting in lower oxygen content of the melt, and higher gas absorption of the reducing materials, such as hydrogen and other gas-forming elements listed previously. Some of the claims that carbon monoxide is not soluble in copper-base alloy melts are based upon a questionable measuring stick, because of the general low quality of all of the metal produced.

Summarizing, there cannot be a final decision made upon the importance of carbon, carbon monoxide, and carbon dioxide as sources of unsoundness in copper-base castings. There are four possibilities whereby these materials could cause unsoundness: (1) Reaction C, Type 2 gas evolution. (2) Reaction D, Type 2 gas evolution. (3) Precipitation of carbon monoxide as the result of decreased solubility, or Type 1 gas evolution. (4) Precipitation of carbon dioxide as a result of decreased solubility during solidification, causing unsoundness by Type 1 gas evolution.

If Reactions C and D occur, the quantities involved are relatively small, and the reacton product must be only slightly soluble. Hence, if possibilities No. 3 and No. 4 occur, then possibilities No. 1 and No. 2 probably would not occur. However, if carbon dioxide were nearly insoluble, and carbon monoxide were substantially soluble, possibilities No. 1 and No. 4 probably would not occur, and CO could produce unsoundness by combination with oxygen by possibility No. 2, or it could precipitate during solidification by possibility No. 3. If carbon monoxide were slightly soluble in the melt, the carbon present would probably exist in the melt as carbon and carbon monoxide, or as carbon monoxide entirely, and it matters a little whether it is Reaction C or D which produces the unsoundness, but these two together constitute the most likely cause of unsoundness. The precipitation of carbon monoxide by Type 1 gas evolution is less likely, and the precipitation of carbon dioxide by Type 1 gas evolution is not at all likely, since it is generally agreed[12, 32] that it is insoluble in copper-base melts.

Sulphur and Sulphur Dioxide as Causes of Unsoundness—Sulphur may be present in the melt as sulphur or a sulphide, or it may be present as dissolved SO_2. Since SO_2 dissolves in copper in proportion to the cube root of the SO_2 pressure, it is assumed that it exists in the melt as one molecule of Cu_2S and two molecules of Cu_2O per molecule of SO_2 dissolved. If sulphur is present as sulphur or a sulphide dissolved in the metal, it could form unsoundness by Type 2 gas evolution according to Reaction B. In view of the above, it is not likely that SO_2 as such would be dissolved in the metal, and Type 1 gas evolution of SO_2 may well be discounted.

There is a good possibility, however, that Reaction B may occur when the melt solidifies as a result of the increased concentration of sulphur or sulphide and oxygen in the remaining portion of the metal not solidified. High percentages of sulphur have been reported as being harmless, while others report[12, 38, 39] a slight adverse effect, one investigator[17] claiming it forms nearly harmless small spherical voids. It may be concluded that sulphur and sulphur dioxide are not serious causes of microporosity in the founding of copper-base alloys.

Nitrogen as a Cause of Unsoundness—Practically all investigators[12, 37, 41, 42, 43] agree that nitrogen does not cause unsoundness. Indeed, most find the maximum soundness is obtained in nitrogen atmospheres. Furthermore, nitrogen is recommended as one means of removing dissolved gases in strongly reducing alloys as described later. The possibility

(*Continued on page 210*)

AFA Apprentice Contest Winner

WHEN Floyd G. Matthews, 25-year-old foundry apprentice of Caterpillar Tractor Co., Peoria, Ill., won first prize in the apprentice molding contest, gray iron division, at the recent Detroit convention, it marked the fourth consecutive year that an apprentice from Caterpillar had won.

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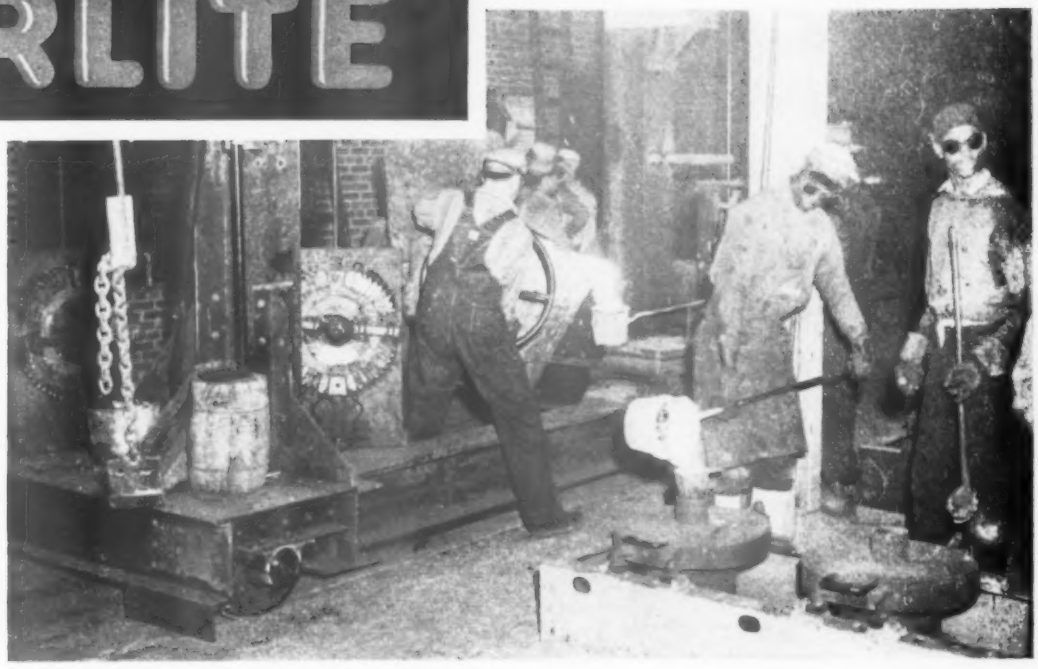

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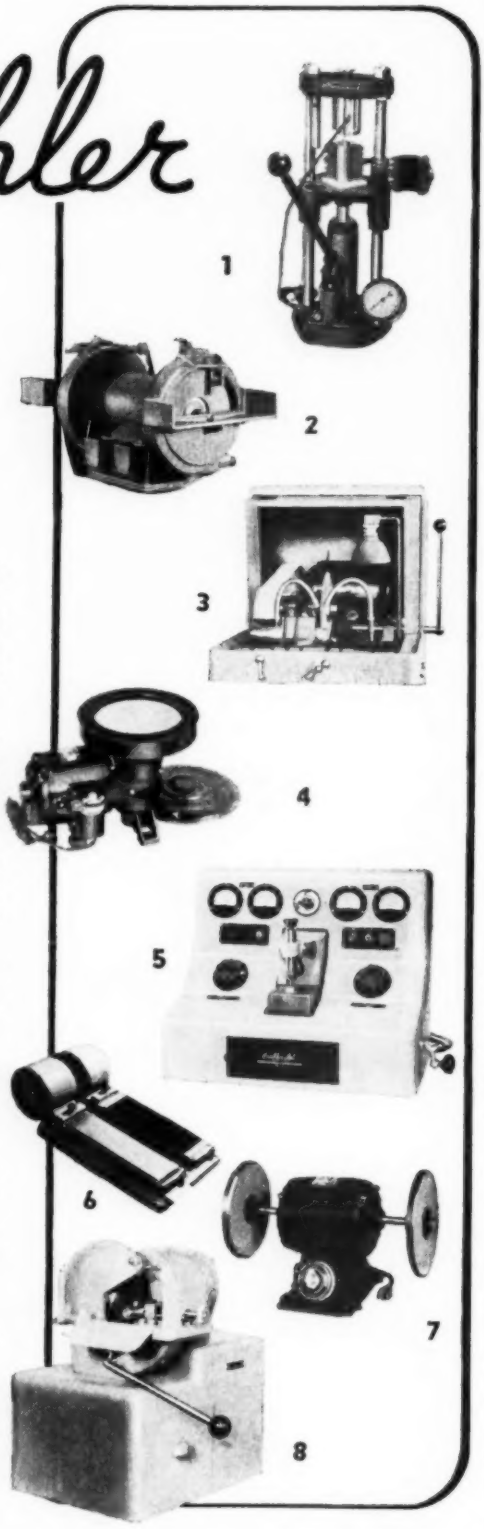

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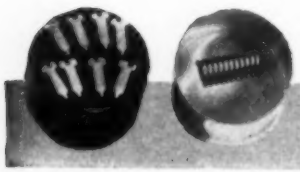

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(*Continued from page 208*)

of nitrogen forming unsoundness by Type 1 gas evolution may, therefore, be discounted.

Summary of Conclusions—It has been noted that there are two types of gas evolution. Type 1 results from decreased solublity of the gas when the metal solidifies. Type 2 results from the combination of the dissolved material with dissolved oxygen when the melt solidifies, forming a nearly insoluble compound which is evolved. The various possible causes of gas unsoundness are listed below in a decreasing order of their seriousness or probability.

1. Hydrogen by Type 2 gas evolution.
2. Hydrogen by Type 1 gas evolution.
3. Carbon monoxide by Type 2 gas evolution.
4. Carbon monoxide by Type 1 gas evolution.
5. Sulphur by Type 2 gas evolution.

It is concluded that carbon dioxide, sulphur dioxide, and nitrogen do not form Type 1 gas evolution, and Type 2 gas evolution would be impossible. Oxygen by itself does not cause unsoundness but, in combination with other materials, probably does cause unsoundness by Type 2 gas evolution. Of the five listed causes of gas unsoundness in copper-base castings, only the first three may be regarded as important, and of these three, the third one is the most conjectural.

Effect of Unsoundness on Casting Properties — Because it is difficult to evaluate quantitatively the amount of unsoundness in copper-base alloys, there are no precise data on the effects of unsoundness on the various properties of castings. It is a well known principle that gas evolution during solidification will distribute the unsoundness and eliminate the localized shrinkage type of defect. One classical commercial example of this phenomenon is tough pitch copper in which residual oxygen and hydrogen unite to form steam in uniformly distributed, small rounded holes throughout the casting or ingot, compensating for the shrinkage and producing a flat-top ingot. Another example is rimming steel. Still another is the high-silicon, corrosion-resistant iron castings.

It is an established fact that aluminum alloys which have been thoroughly degassed require better feeding to compensate for shrinkage, than gassy melts which produce a substantial volume of generally distributed pinholes.[15] Likewise, the presence of some gas evolution during the solidification of copper-base alloy castings will eliminate or reduce localized shrinkage, producing a more uniform distribution of the voids. Localized shrinkage is a potent cause of leakage, and it has been demonstrated that a small

(*Continued on page 212*)

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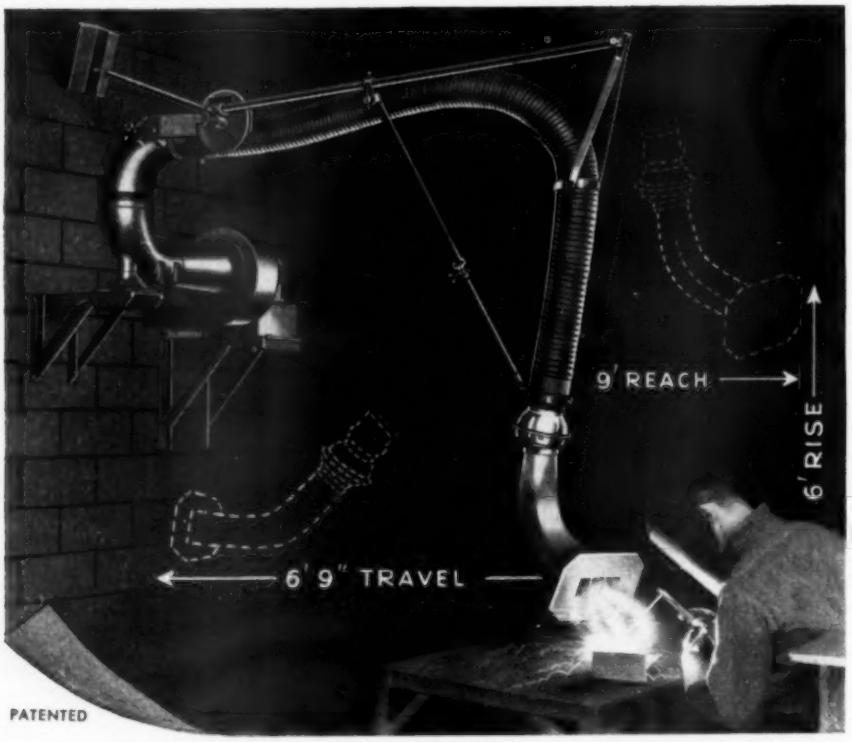

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(*Continued from page* 210)

amount of gas produces a lower percentage of leakers than thoroughly degassed or very gassy melts.[16] The amount of gas required to produce a minimum of leakers would, of course, depend upon the alloy, the part being cast, as well as upon the method by which the casting was gated and risered. Thus, a certain small gas content improved chill cast bronze, but was injurious when the melt was sand cast.[17]

Since the presence of some gas evolution during solidification will produce a more uniform distribution of the porosity, it is conceivable that the mechanical properties of certain sections, which might otherwise contain localized shrinkage, would be improved by a certain amount of gas evolution during solidification. In general, however, voids of any kind in a casting produce an adverse effect on the mechanical properties. Such voids will affect some mechanical properties more than others. Thus, the following list of properties is increasingly adversely affected by porosity: Yield strength, tensile strength, per cent elongation, resistance to failure by impact, resistance to failure by fatigue.

Voids Produce Stress

With the possible exception of the yield strength, the porosity does not reduce these properties in proportion to the reduction in cross-sectional area which the voids produce. On the contrary, the voids produce stress concentration, particularly if the voids are angular in shape. The angular porosity will act as stress raisers, producing a notch effect in the section. For this reason, angular porosity has a greater adverse effect upon endurance and impact values than upon yield strength, which probably is decreased only in proportion to the reduction in the effective cross-sectional area of the section. The volume of the voids, therefore, does not give an accurate indication of their effect on the mechanical properties.

A given percentage of rounded holes would be expected to have little effect upon the mechanical properties, while the same percentage of markedly angular and intergranular voids would have a very harmful effect. Unfortunately, the latter description fits the microporosity which generally occurs in copper-base castings. It has been noted a small amount of gas evolution will reduce the number of leakers, because it produces a more uniform distribution of the porosity and will partially eliminate localized shrinkage of poorly fed castings. Localized shrinkage is the worst cause of leakers. Microporosity, as described at the outset of this series of papers is also

(*Continued on page* 214)

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(*Continued from page* 212)

a cause of leakers. Consequently, high gas content, causing a considerable gas evolution during solidification, increases the amount of microporosity and, accordingly, increases the number or percentage of leakers.

Wherever possible, the reduction in the percentage of leakers should be obtained (1) by proper gating, chilling, and risering to produce a maximum soundness, (2) by using a melt of high quality, i.e., one of low gas content, and (3) by the selection of an alloy least susceptible to the formation of leakers. In general, such compositions are also least susceptible to the formation of microporosity. Lead is frequently resorted to as an addition to improve leak tightness because the lead will occupy and partially fill in voids which would normally be present as shrinkage and microporosity. The proper gas content to produce a minimum of leakers would be very difficult to control, and would vary with the casting design and other foundry practices.

Methods of Measuring Gas Content of Copper-Base Alloys — In common with gas measurements on other metals, there are a few well defined methods of measuring qualitatively or quantitatively the gas content of copper-base alloys. These methods are as follows: (1) by gas absorption, (2) by vacuum melting, (3) by evacuation of the solid, (4) by vacuum solidification, (5) by sectioning, (6) by density measurements, and (7) by the mechanical properties of suitable test specimens.

The gas-absorption method has been described in the literature, and essentially consists of measuring the amount of a given pure gas which is dissolved by a certain quantity of metal at any specific temperature. This is the method generally used, and the maximum solubility of a given gas at a given temperature can be obtained by this procedure in a very satisfactory manner. The method is, however, entirely academic and is not applicable to foundry work, but it does show, if properly executed, what gases can be dissolved in the melt, and the maximum quantity.

The second and third methods listed involve vacuum melting, or evacuation of the hot solid. By these methods, a specimen is melted or heated under a vacuum, and the gases collected are measured and analyzed. If the methods were reliable, it would give an indication of the gas content of the *solid metal*. However, owing to the surface gases on the metal and on the equipment, the method is fraught with many difficulties, and the results obtained, unless very carefully done, are unreliable and contradictory.

(*Continued on page* 216)

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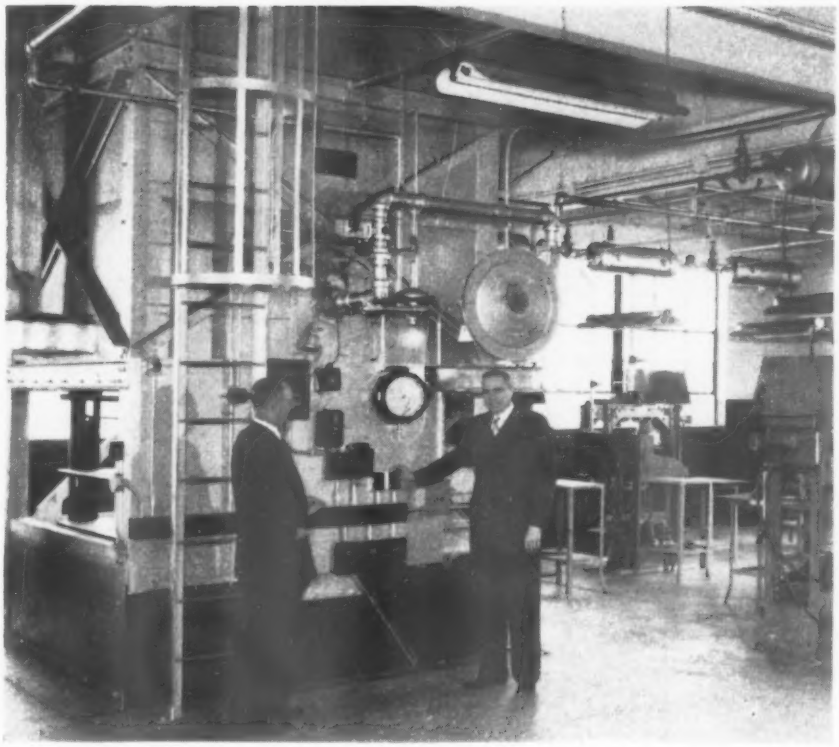

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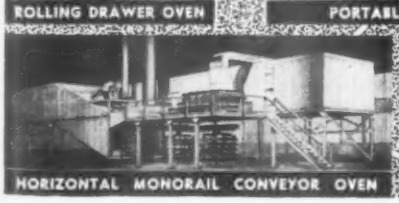

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CORE AND MOLD OVENS

(*Continued from page* 214)

The reverse of this process, the fourth method, whereby a melt is solidified under a vacuum and the evolved gases are measured and analyzed, is somewhat better in principle. Again, however, the experimental difficulties are very great because the adsorbed gases on the surface of the equipment may give misleading and erroneous results, and, as noted in Table I, the quantity of gas causing the trouble may be very low indeed, and it might be missed. However, this method has some merit.

Three Additional Methods

The remaining three listed methods of measuring the gas content do not lend themselves to the identification of the gas involved. This must be deduced from the experimental conditions under which the melts were prepared and cast. However, they have the advantage of specifically showing the amount, shape, and effect of the voids produced in the solid casting. In general, the best technique is to combine these three methods. Microradiography or sectioning will show the size, shape, and distribution of the porosity in the plane sectioned. The density measurments will show the total percentage of voids in the castings, and the determinaton of the mechanical properties will give an indication of the effects of the melt quality on the properties investigated.

Since these three methods deal with examination of the casting, it is important that the voids present be produced as a result of the gas content of the melt only, and do not arise in any way from shrinkage or poor feeding. This requires the design of a very good and suitable test bar, or test bars. It should also be noted that the density will depend not only on the percentage of voids, but also on the composition of the specimen. The most reliable method would consist, therefore, of determining the density of the cast specimen, followed by a determination of its density after the voids have been collapsed by suitable working of the specimen.

Reduction of Microporosity—Under the heading, "Types of Unsoundness Produced by Gas Evolution, (THE FOUNDRY, May, 1947) it was indicated that microporosity could be reduced (1) by selecting an alloy least susceptible to this type of defect, (2) by proper gating, risering, and chilling to produce steep temperature gradients toward the risers during solidification, and (3) by reduction of the gas content of metal. All three of these factors should receive full consideration to attain maximum casting soundness, but only the latter of these three has been considered in detail in this series of papers. Likewise, in this paper, only methods of reducing the gas content of the melt will be considered.

These most important methods of reducing gas absorption during the melting process or eliminating it after the melting operation is completed may be grouped under two general headings: (1) Exposing the metal to oxidation during and/or after the melting is complete and deoxidizing it just before pouring, and (2) subjecting the melt to a degassing treatment by passing an inert gas through it. A third method more widely used among light-alloy foundrymen consists of permitting the melt to solidify in the crucible and remelting it as quickly as possible. There is also a fourth method, not properly a degassing treatment, however, which is frequently recommended as a means of reducing porosity. Since in a broad sense it is in part a metal treatment, the factor may be considered at this point. This factor is control of the pouring temperature.

Degassing by Oxidation—The theory upon which the oxidation-deoxidation treatment for degassing copper-base alloys is based has already been considered. The most commonly used method of subjecting the melt to oxidizing conditions consists of the maintenance of an oxidizing atmosphere during the melting operation, and this is universally recommended. Such oxidizing atmospheres are always obtained in induction furnaces but they can also be controlled when a gas fuel is used. Some foundries set the mixing valves to produce a gas-air mixture that will provide about 0.5 per cent O_2 in the products of combustion with zero per cent CO, the balance being CO_2, moisture, and nitrogen. Oil-fired furnaces do not lend themselves as readily to atmosphere control.

Other methods recommended for the attainment of oxidizing conditions comprise the utilization of an oxidizing slag or flux.[14, 16, 17] This material can be used in the bottom of the charge or on top of the melt. Copper oxide and manganese oxide are the most commonly recommended oxidants. For a 1.5 per cent phosphor bronze, 3 per cent by weight of a flux consisting of two parts Cu_2O, one part sand, and one part borax was required to produce degassing. At 0.75 per cent phosphorus, only one part each of these constituents was required as a cover.[18] It has aready been noted that alloys which are not strongly reducing are the most amenable to degassing by oxidation treatment.

There is some difference of opinion whether or not oxidation is beneficial in phosphor bronzes.[14, 16] It is quite likely, however, that such strongly reducing alloys as those containing substantial amounts of zinc are benefited by melting under oxidizing conditions.[2] Deoxidation is usually effected by adding phosphor copper just before pouring so that approximately 0.02 per cent residual phosphorus is obtained, unless, of course, higher phosphorus contents are specified as in phosphor bronzes.

The possibility of carbon absorption from crucibles can be avoided by the use of refractory-lined furnaces, and pouring the melt from these furnaces to pouring ladles. Barrel-type gas-fired furnaces are representative of such designs.

Degassing by Using a "Scavenging" Gas—The second recommended method of reducing the gas content of copper-base alloys is particularly applicable to those of a strongly reducing nature. By this method, the hydrogen, which is a principal cause of difficulty, as previously noted, is gradually removed from the melt by the scavenging action of the nitrogen.[16] This method is widely used for some light alloys.[15] It is not necessary that the gas used for scavenging have any chemical affinity for the hydrogen. The nitrogen is introduced into the melt through a suitable steel or refractory tube. The bubbles of nitrogen escape from the bottom of the tube and rise upward through the alloy melt. These nitrogen bubbles supply a gas-metal interface at which the hydrogen atoms in solution can attach themselves by the process of adsorption. From this interface they combine to form molecular hydrogen and escape into the nitrogen bubble which rises to the surface and carries the hydrogen with it.

It is most definitely true when using nitrogen in the light alloys,[15] and it is probably also true for copper-base alloys, that the nitrogen must be relatively free from oxygen and water if it is used as a scavenger rather than as a means of oxidizing the melt. It is evident that if a substantial amount of oxygen is present in the nitrogen, the hydrogen removed from the melt will be oxidized to form moisture. The moisture, in turn, will react readily with the melt, forming

(*Continued on page* 218)

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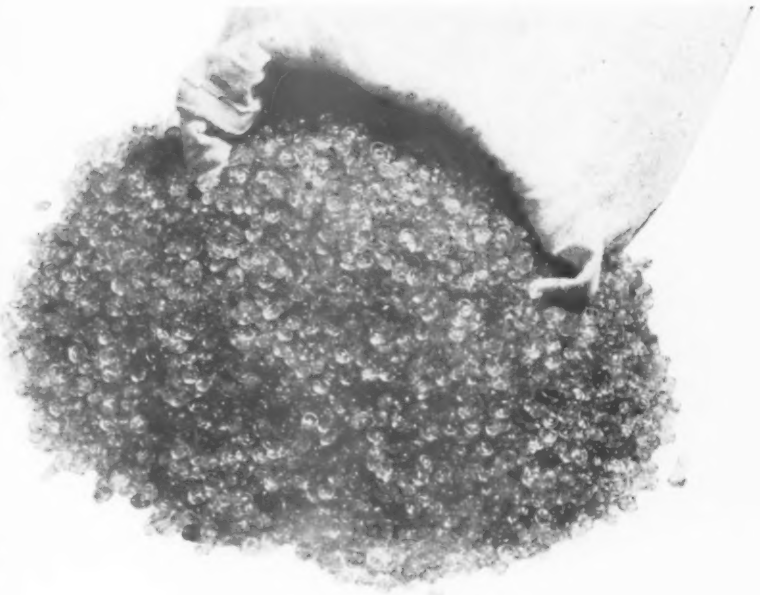

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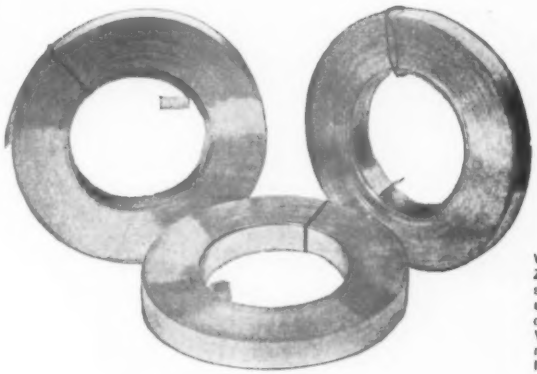

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(*Continued from page* 216)

atomic hydrogen, which may be reabsorbed by the melt. For the same reason, it is evident that the nitrogen should be substantially free of moisture. For this reason, oil-pumped nitrogen is generally recommended for such purposes. Since copper-base alloys containing zinc have a high zinc vapor pressure, this zinc vapor may be expected to have a scavenging effect in removing hydrogen, similar to nitrogen. This effect has been reported.[39] Furthermore, high-zinc alloys produce copious fumes when treated with nitrogen.

Degassing by Presolidification — The method of degassing by permitting the melt to solidify and then quickly remelting it has also been recommended.[45] This method is quite widely used in some foundries for degassing light alloys. The theory upon which this method is based is quite simple. The gas absorbed during the melting operation is largely precipitated when it solidifies. Consequently, if the melt is permitted to solidify, the gas is evolved. If hydrogen is the principal source of difficulty, the hydrogen atoms will combine to form molecules and the molecular hydrogen is much less readily absorbed than atomic hydrogen. Consequently, if it is permitted to precipitate from the melt by solidification, it is not readily reabsorbed, even though it is retained in some of the voids in the solidified mass, unless it is adsorbed on the cavity surface, i.e., dissociated into atomic hydrogen. The melt is then rapidly remelted and poured off in the regular way.

The effectiveness of this method of degassing depends upon the amount of gas reabsorption which may occur during the second remelting. If surface gases adsorbed on the ingot and scrap are an important gas source, as is the case when melting some light alloys, solidification and remelting is a quite effective means of improving melt quality. However, if gas absorption is largely from the atmosphere surrounding the melting operation, it is not likely that this method will be very effective or reliable.

Other Proposed Methods of Reducing Microporosity—Close control of the pouring temperature has been recommended[40, 47, 48] as a means of controlling the amount of microporosity. There is no doubt that most copper-base alloys are less susceptible to the formation of microporosity at low pouring temperature at which maximum soundness is obtained. Normally, however, such good temperature control is applied to the production of the test bars only. On a practical basis, the actual pouring temperature at the mold in the foundry will largely be determined by the provision of an ample temperature to avoid an unreasonable loss from misruns, and associated cold shuts, and even though the casting may be poured at a fairly low temperature, the actual temperature at which the casting is usually poured may be largely determined by expedience. Certainly very close control of the pouring temperature, though very desirable, cannot be regarded as a substitute for adequate melt quality. It will also be shown in a later paper that low pouring temperature and maximum soundness do not always coincide with maximum mechanical properties.

Slow pouring rates, producing more directional solidification, improve the soundness of chill-cast, top-poured billets.[18]

In view of the role of oxygen in the Type 2 gas evolution, it is logical that if melts could be produced free from oxygen, no difficulty would be encountered. This method has been proposed,[49] and some data have been submitted to show that copper-base melts can be melted under hydrogen, phosphorus added, and the melt poured, producing good-quality castings.[27] If these data can be accepted as reliable, it would indicate that hydrogen did not produce any

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trouble by the Type 1 gas evolution.

If the presence of carbon and/or carbon monoxide causes unsoundness, difficulties from this source could be avoided by using an atmosphere low in carbon monoxide. It has already been noted that it is necessary to do this in order to have a properly oxidizing atmosphere during the melting operation. It would also be necessary to avoid contact with carbon, or a carbon-containing material. The most common source of carbon is the contact of the melt with a carbon-containing material, such as a clay-graphite crucible. This could be avoided by proper selection of the melting equipment. It should be emphasized that carbon as a source of unsoundness has not been established.

It has been reported that some alloys, particularly the high-phosphor bronzes, absorb gas, presumably hydrogen, when they are poured into green sand molds. This is also true of some aluminum-base alloys, and, in this instance, the gas absorption can be greatly reduced by using molding sands of low moisture and relatively high permeabilities.[15] It is known, however, that 85-5-5-5 alloy is not markedly sensitive to either the moisture content or AFA permeability of the green sand molds used. Very little information is available on this subject, but recent work on this problem will be considered in more detail.

Gas Absorption in the Mold—It has been reported[16] that high-phosphorus bronzes, such as one containing 10 per cent tin and 0.7 per cent phosphorus, are the most subject to gas absorption from contact with gases in the mold. This gas absorption was reported to be greater the greater the contact with the sand, and to be more pronounced with various types of bonds in the following order: (1) oil bond, (2) cereal bond, and (3) clay bond. The gas absorption decreased with increasing permeability of the sand, and a synthetic sand produced less gas absorption than a natural sand. Sands containing several per cent of water produced less gas absorption than sands baked at moderate temperatures and this was attributed to the water causing a chill on the casting surface. However, the true explanation may be that the water forms a protective oxide skin, through which hydrogen is not readily absorbed. If it were a matter of cooling rate only, then the gas unsoundness should be very sensitive, rather than slightly sensitive, to section thickness.

Gas absorption also decreased with increasing baking temperature, but a bake at 1472 to 1650 F was required to remove all of the combined water and eliminate gas absorption. It was found that extended baking time for a given temperature was without benefit. Gas ab-

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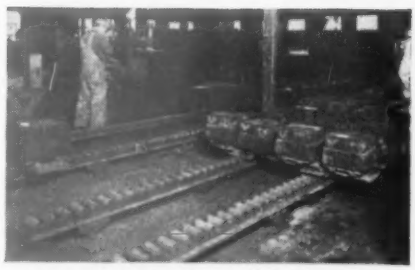
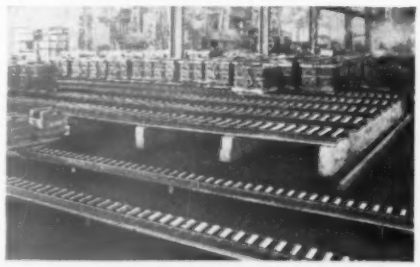
Investigate Standard's complete line of roller conveyors—especially designed for foundry use. Their smooth action handles the most delicate core with little or no chance of damage. Their extra husky construction with shielded or sealed bearings give perfect protection against heat, dirt, sand, chips and grit, with resulting long time trouble-free operation.

Whatever your needs, Standard Conveyor Co. has a wide range of conveyors for foundry application. A short section — or a complete system of varying widths, weight carrying capacity or combinations can be furnished to meet individual requirements. If you want ideas on foundry conveyor applications write for bulletin F-747.

STANDARD CONVEYOR COMPANY
General Offices: North St. Paul 9, Minn.
Sales and Service in Principal Cities



MOLDING FLOOR
When molding's complete — loaded on conveyors — jobs move smoothly and quickly to next stop.



STORAGE
All lined up ready for pouring and moving to shakeout — and return to molders.

POURING AREA
Neatly aligned, the pouring job is simplified — molds can be quickly moved out of the way for cooling and shakeout.

STANDARD
Gravity and Power
CONVEYORS

ENGINEERED FOR FASTER PRODUCTION

sorption also increased with increasing pouring temperature, but pouring rate had no effect. However, rapid pouring would permit a lower pouring temperature which, in turn, reduced gas absorption in the mold. Degassing the melt was found to be beneficial in that a sounder casting was produced for a given gas absorption from the mold. In other words, gas absorbed from the mold was added to that which already existed in the melt. The lower the initial gas content of the melt, the lower the final gas content after some gas had been absorbed from the mold material.

It was also stated that gas absorption in the mold decreased with decreasing phosphorus content until 0.075 to 0.25 per cent phosphorus is reached. These "low" phosphorus bronzes were reported to absorb more gas from an oil bond than from a clay bond baked at 570 F. Thus, the relative effect of a clay bond and an oil bond are reversed with low phosphorus alloys. Increasing the tin content slightly increased the gas absorption, and an 88-10-2 alloy absorbed gas about equivalent to the low-phosphorus tin bronze. An increase in zinc content at least up to 5 per cent also increased gas absorption in natural clay-bonded sand. An increase in the lead markedly reduced gas absorption from the mold. Unlike phosphorus, silicon and 0.1 per cent aluminum caused a very severe increase in difficulties with dross, but gas absorption was reduced because of the protective action of the surface skin.

Thus, phosphorus, zinc, and tin additions increased gas absorption from the mold to a decreasing extent, while lead decreased gas absorption. This was tentatively attributed to the decreasing heats of formation of the oxides in the series.[7] Thus, if the heat of formation of the oxide is taken as an indication of the affinity of the element for oxygen, phosphorus would reduce the oxygen content of the melt to the greatest extent and would permit greater absorption of hydrogen, as outlined previously when commenting on Fig. 5. Aluminum and silicon would, presumably, also fit in this series were it not for the protective skin they tend to form.

Differences In Behavior

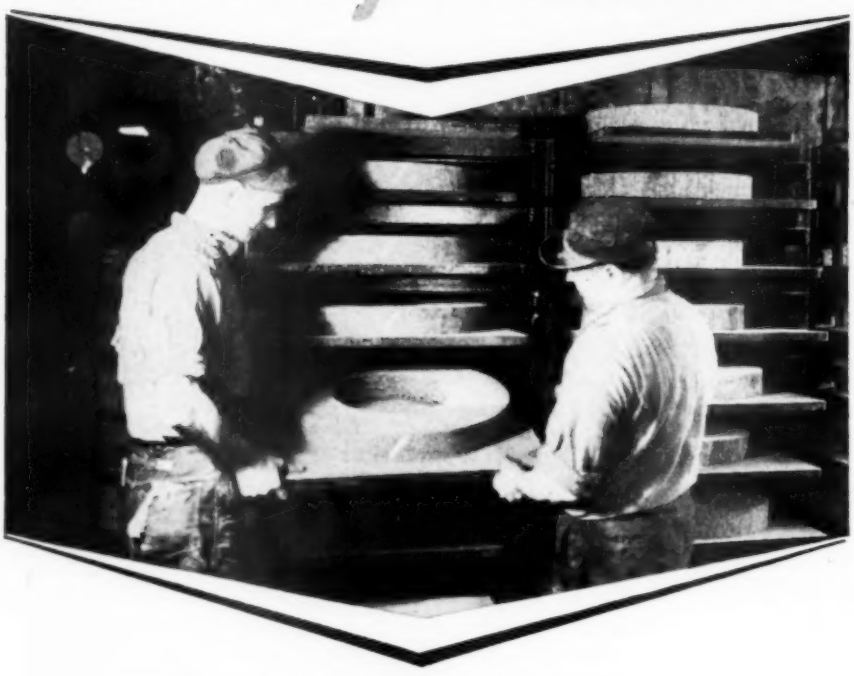
It will also be noted that organic material, such as oil bond, was reported to be the most severe gas source for low-phosphorus bronzes, while clay-bonded sand was the most severe gas source for high-phosphorus bronzes. There is no satisfactory explanation for this difference in behavior and it may be well to withhold final conclusions until further data are available on this point.

Not a great deal of work has been done on the effects of mold material, but recent investigations[8] on 85-5-5-5 alloy indicate that moisture content of the green sand and its permeability have little effect when making these tests. The alloy was deoxidized before pouring, with 2 ounces of 15 per cent phosphor copper per 100 pounds of melt. But this insensitivity to permeability and moisture in green sand probably does not apply to dry sand because such molds baked at moderate temperatures promote gas absorption in the mold more readily than those containing several per cent of water or those baked at 1200 to 1700 F, for the probable reasons given above. Furthermore, the insensitivity of green sands to moisture content or permeability is not proof that some gas is not absorbed from them.

Summary—Listed in a decreasing order of probable importance, the sources of unsoundness in copper-base alloys are: (1) hydrogen by Type 2 gas evolution, i.e., by the formation of the compound, H_2O, (2) hydrogen by Type 1 gas evolution, (3) carbon or carbon monoxide by Type 2 gas evolution (4) carbon monoxide by Type 1 gas evolution, and (5) sulphur by Type 2 gas evo-

(*Continued on page 222*)

"I do the job faster..."



Transite Core Plates offer all these advantages:

They speed production—Core makers save trips . . . handle many plates at one time.

They last longer—Made of fibrous asbestos and cement, Transite Core Plates resist shock . . . are less likely to crack or break.

They clean easily—Core wash, sand, etc., do not stick as readily as to other materials. Both sides are usable.

They resist corrosion and warpage—Transite Core Plate surfaces stay smooth even after long service. Warpage is less than 0.1%.

They are economical—Low price, low maintenance and long life add up to low costs.

To eliminate green cores and reduce baking time perforated plates are also available.

JM

Johns-Manville

Box 290, New York 16, N. Y.

TRANSITE CORE PLATES MADE OF ASBESTOS

NORTON REFRACTORIES LIKE HEAT

In a variety of induction melting furnaces —as well as fuel-fired and direct arc type furnaces—Norton Refractory Cements give long lining life. A series of high temperature cements—made of fused alumina, fused magnesia and mixtures of these materials is available—the right mix to be determined by the many factors present with each melting operation. If you are melting copper, high copper alloys, nickel chromium alloys or alloy steels you can profit by lining your furnace with a Norton Refractory Cement.

NORTON COMPANY • Worcester 6, Mass.

(*Continued from page 220*)

lution, SO_2, CO_2, and nitrogen are not likely causes, if unsoundness in copper-base alloys by Type 1 gas evolution and Type 2 gas evolution is not possible.

The methods of measuring the melt quality and gas content are as follows: (1) measurement of the amount of absorption of a specific gas by a specific alloy at a specific temperature, (2) measurement of the quantity and kind of gases obtained when heating or melting the alloy under a vacuum, and (3) the determination of the kind and quantity of gas evolved by a specific alloy melt by solidifying it under a vacuum. Three additional qualitative methods consist of (4) the machining of sections and subjecting them to microradiography or polishing, and examining them to determine the amount, size, shape, and distribution of the porosity, (5) the measurement of density to determine the total amount of voids, and (6) the determination of the effect of melt quality upon the mechanical properties of suitable test-bar castings.

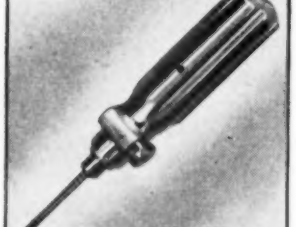
The combination of these last three methods of measuring melt quality is very sensitive to the very small amounts of gas evolution, and permits an evaluation of the most practical aspect of the problem; namely, the total amount, size, distribution, and effect on the test-bar properties produced by the microporosity accentuated by the gas in the melt. It does not, however, permit the quantitative determination of the gas in the melt or its identification. The first can be estimated from the percentage of voids, and the latter must be inferred from the melting conditions employed. It is obvious that the successful application of a combination of these three methods of estimating the melt quality requires the use of reliable test bars which do not introduce unsoundness as a result of inadequate feeding or undesirable structures resulting from improper directional solidification or from excessive mass.

The two most widely used methods of securing a low gas content are as follows: (1) melting under oxidizing conditions and/or subjecting the melt to oxidizing conditions. This may be done by using an oxidizing atmosphere during and after the melting operation, or an oxidizing slag may be used on the bottom of the charge or on top of the melt. Such slags usually contain copper oxide, or manganese oxide as the oxidant. This method is most applicable to alloys which are not strongly reducing, such as those low in phosphorus. The second method of degassing consists of passing an inert gas such as nitrogen through the melt. The dissolved hydrogen adsorbs on the nitrogen bubble and diffuses into it as it rises through the melt. This method of degassing is particularly applicable to strongly reducing alloys which cannot be readily degassed by the oxidation deoxidation method.

New Type of Torque Tools Incorporate Spring Clutch! . . . Are 98% Accurate!

Acme Torque Wrench and Screw Driver both incorporate spring clutches, with easily operated control. After setting control to desired torque, the operator merely turns tool in the usual way. When the torque required to drive the threaded part exceeds the pre-set value, the tool slips. Impact doesn't cause driving torque to increase. Oil doesn't affect setting which is reproducible within 2% or better.

The Wrench offers right and left-hand drive, ratchet action and withdrawal. Spring clutch may be set from 0 to 500 inch pounds. Standard sockets are interchangeable. The Screw Driver may be set for any value of torque from 0 to 35 inch pounds. A ratchet action is incorporated. The same tool will also withdraw screws. Standard bits, including socket types, may be easily inserted. The tool is made of pressure cast aluminum.



Torque Screw Driver

Another Time-Saver on the job, is chewing gum. The act of chewing aids the workers' concentration—seems to make the work go easier. Chewing gum may be used even when workers' hands are busy; reducing interruptions from the job. For these reasons many plant owners have made Wrigley's Spearmint Gum available to everyone.

You can get complete information from Acme Scientific Company, 1450 W. Randolph St., Chicago 7, Ill.

AB-64

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FOUNDRY IS A GOOD PLACE TO WORK

(*Concluded from page* 95)

program, for example, always may be set up to provide pre-placement physical examinations including chest x-ray diagnosis, periodic re-examination, regular medical consultation service and nursing care. The large foundry or the smaller captive one operating as part of a big plant may provide an extensive hospital with a full-time physician in charge, a corps of nurses and elaborate equipment including x-ray apparatus. On the other hand, the small foundry may extend the same protection to its workers through a physician specializing in foundry problems who will take the responsibility of setting up a medical program. This is particularly true in the larger industrial centers where a single medical unit may be set up to serve several small establishments.

Mechanization of processes, which has so great a bearing on the possibility of dust and heat control and the elimination of a great proportion of manual handling of materials, must be engineered on a tailor-made basis. Practically speaking, no two foundries are alike, and it is realized the problems encountered in a gray iron, steel, brass, or even another aluminum foundry, probably will differ from those at the U. S. Rubber Co. Irrespective of local conditions, mechanization together with modernization of medical facilities, lighting, sanitation, and housekeeping will pay dividends in improved employee health, morale and output per man.

G. L. Ohrstrom & Co., 40 Wall St., New York, and associates have purchased the Ohio Pattern Works & Foundry Co., 2735 Colerain Ave., Cincinnati.

CHOOSING THE RIGHT
Dings Lifting Magnets
for your jobs...

• How big?
• Heaviest loads?
• Kind of material?
• Costs . . .
—Better, faster materials handling?
—Operation and maintenance?

BUILDING the finest lifting magnets that 47 years of experience can design is only part of the Dings job in seeing that you get top, long-run efficiency for the particular jobs your Dings Lifting Magnets have to do.

Lifting magnets too big for the job run up unnecessary operating costs . . . Magnets too small waste time and money in extra lifts required . . . The type of material handled sometimes makes a tremendous difference in lifting magnet tonnage capacities . . . For example a 65" Dings Lifting Magnet will pick up slabs weighing 65,000 lbs.—but will lift only 3,500 lbs. of melting scrap!

You can be sure of getting the *right* lifting magnets for fastest, most economical handling of your materials by calling in Dings Engineers to make recommendations on your particular jobs.

Remember: size for size, *no one* builds more powerful lifting magnets than Dings!

This new Dings Catalog has the facts!

Just off the press! A new Dings Lifting Magnet Catalog full of illustrations, performance and operating data, lifting magnet power requirements, and the reasons, in design and construction details, why Dings Lifting Magnets give you dependable, full-power lifting ability over long periods on the toughest jobs. Ask Dings for Catalog No. 220 today!

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Dings
"HIGH INTENSITY"

"SEPARATION HEADQUARTERS SINCE 1899"

Industry BRIEFS

CENTURY Electric Co., 3727 Market St., St. Louis, Mo., has begun construction on a foundry addition. New building and machinery will cost approximately $1 million and will double present production capacity. Company produces gray iron castings for its own use in the manufacture of electric motors, and electric-furnace alloy castings for drums, cylinder liners for engines, rear axle housings for tractors and other items for agricultural machinery.

° ° °

American Foundry Co., 1535 Naomi St., Indianapolis, plans construction of a $2 to $3 million foundry at South Tibbs Ave. and West Morris St., that city. The new plant will be in addition to present operations and will produce 500 tons of automotive castings daily. It is expected to be in production about Jan. 1.

° ° °

Anderson Engineering Co., 2032 Santa Fe Ave., Los Angeles, now services the entire state of California with the line of dust and fume control and ventilating equipment manufactured by Claude B. Schneible Co., Detroit. The Anderson company has represented Schneible in the Los Angeles area since 1938.

° ° °

Shipments of ingot brass and bronze for April, 1947, amounted to 24,577 tons as compared with 27,477 tons shipped during March and 32,731 tons in April, 1946, according to the Ingot Brass and Bronze Industry, 308 West Washington St., Chicago 6. These figures were formerly released by the Defense Council of the Ingot Brass and Bronze Industry which is no longer in existence.

° ° °

Builders Iron Foundry, 9 Codding St., Providence, R. I., has contracted with Meehanite Metal Corp., Pershing Square Bldg., New Rochelle, N. Y., for the manufacture of Meehanite castings. Most of the company's castings production will be used in the fabrication of precision recording, indicating and controlling instruments for industrial and power plants, and venturi instruments for water works and sewage plants, equipment which is produced in its subsidiary, Builders-Providence Inc.

° ° °

Deming H. Lucas, manufacturers' representative, 1511 Touhy Ave., Chicago 26, has been appointed by J. Thomas Rhamstine, Harlingen, Tex., as exclusive representative in Illinois, Indiana and Wisconsin, for the latter's foundry sand moisture meter.

° ° °

Cast Rite Aluminum Co., formerly located at 2636 W. Huron St., Chicago, on May 1 occupied new quarters at 1551 W. Fulton St., Chicago 7. Company was organized in November, 1945, to produce aluminum castings.

° ° °

Mercer Foundry & Mfg. Co., Danville, Ill., suffered a fire Apr. 12 which completely destroyed its plant. Loss is estimated at $200,000. Company makes gray iron, brass and aluminum castings.

° ° °

Gray iron casting production for April in the Philadelphia Federal Reserve District increased 4.3 per cent over March and 3.6 per cent over April, 1946, according to the University of Pennsylvania's Industrial Research department. Malleable iron casting production increased over the previous month and last year by 33.8 and 38.8 per cent, respectively. Steel casting production was 1.4 per cent below that of March and 3.6 per cent under April, 1946. Production of nonferrous castings declined 0.3 per cent from March but was 45.4 per cent above a year ago.

° ° °

Carborundum Co., Niagara Falls, N. Y., recently purchased for $200,000 the former assembly plant of Philco Corp., 3345 West 47th St., Chicago. Property consists of a reinforced concrete office and warehouse building containing 35,000 sq ft of floor space. An additional office and manufacturing floor is planned which will give the company a total of 57,000 sq ft to be used for its sales office and distribution facilities.

° ° °

Wisconsin Industrial Service Co., Milwaukee, has been opened by Charles W. Berger to sell castings, forgings, pipe, gears, sprockets and other items. Mr. Berger formerly was purchasing agent in Allis-Chalmers steel division.

° ° °

Metal Cast Corp., Charlestown, Ind., newly formed foundry, has begun construction of its foundry building. Frank Ferguson will be general manager of the foundry, which will produce aluminum castings.

° ° °

Kuhlman Diecasting Co., 5111 East 24th St., Kansas City, Mo., plans construction of a $200,000 diecasting plant at the corner of Seventeenth St. and Crystal Ave., Kansas City.

° ° °

Paul-O-Cast Co., formerly M & M Foundry, 4835 Staunton Ave., Los Angeles, will build an 8500 sq ft plant at Loren & Todd Sts. Company makes cast iron soil pipe and fittings.

° ° °

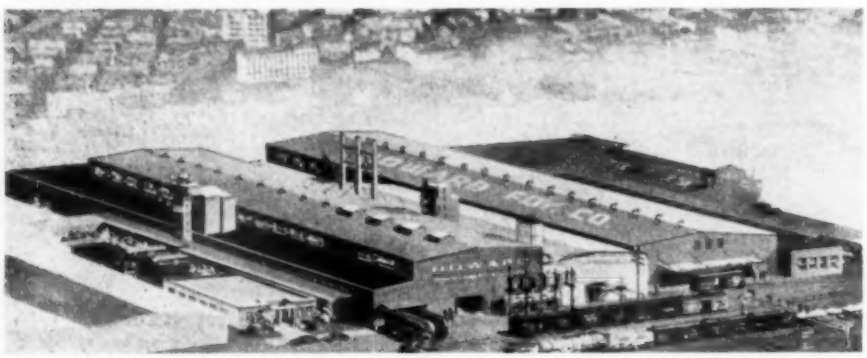
Valley Brass Co., 137 North Maxon Rd., El Monte, Calif., has obtained building permit for construction of a brass foundry. New building will provide 4000 sq ft of floor space.

° ° °

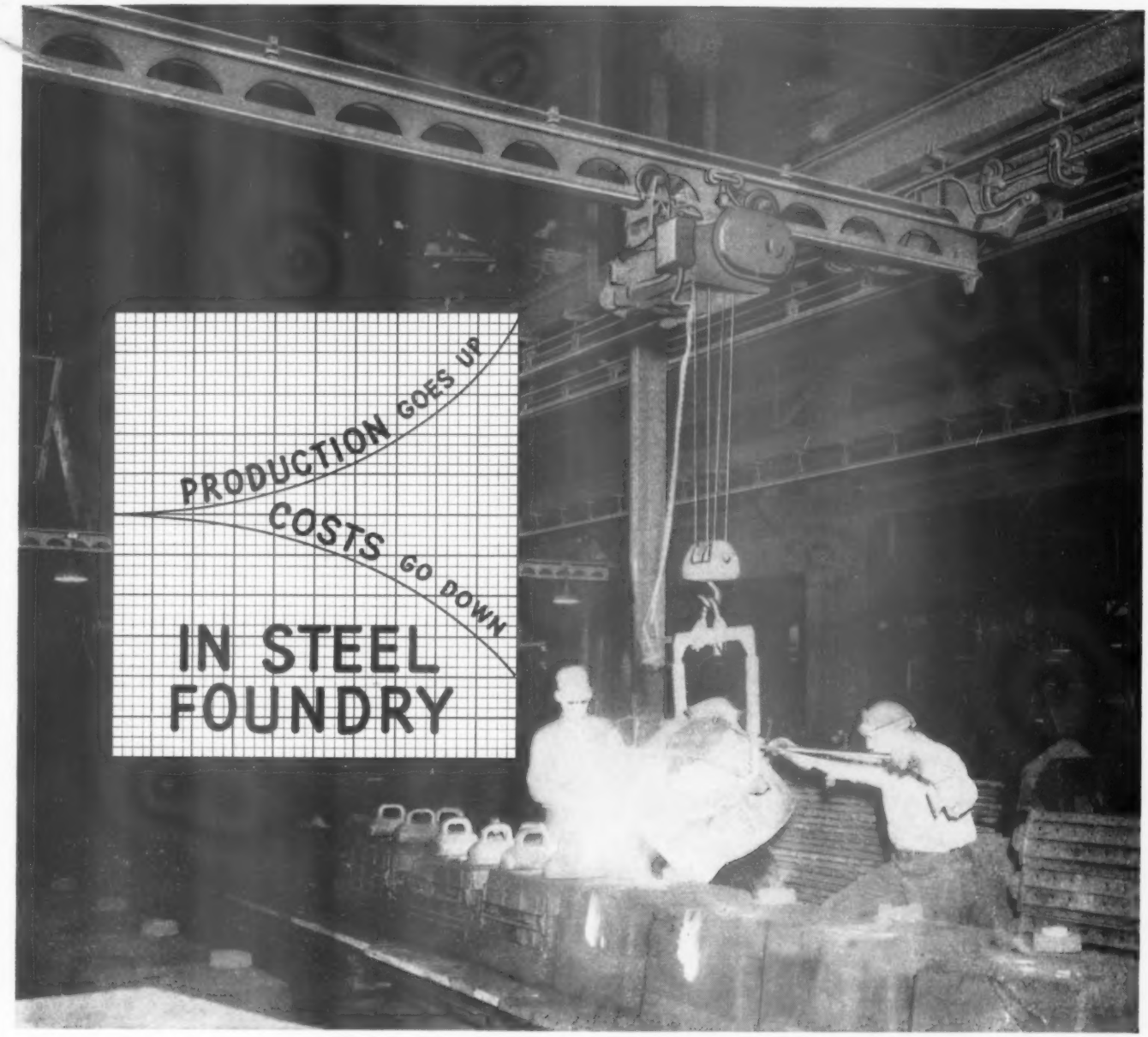
Lavelle Gray Iron Foundry Corp. and Lavelle Non-Ferrous Casting Co., 23rd and St. Charles St., Anderson, Ind., have recently moved into a modern plant at

(*Concluded on page* 226)

Howard Acquires West Coast Foundry



View of Howard Foundry Co.'s newly acquired plant at 1985 East Sixteenth St., Los Angeles. In addition to facilities for making magnesium, aluminum (both sand and permanent mold) and brass castings and wood and metal patterns, Howard's Pacific Coast division now has complete equipment for manufacturing alloy steel castings (including stainless steel) in accordance with the same modern control methods used in its eastern plants



When a large Steel Foundry installed an overhead Cleveland Tramrail system to serve its pouring floor two significant things happened: (a) production increased greatly, (b) costs went down.

Factors contributing to these results were:

1. Enabled use of larger pouring ladles
2. Provided efficient working routine
3. Reduced delivery time of metal to molds
4. Decreased heat loss in metal
5. Eliminated much hand lifting, lugging and hard labor
6. Minimized worker fatigue
7. Promoted safety

Because of the phenomenal success with the pouring floor installation, Cleveland Tramrail was installed in other departments with equally remarkable results. In nearly every instance the equipment paid for itself within the first six months of operation.

GET THIS BOOK!

BOOKLET No. 2008. Packed with valuable information. Profusely illustrated. Write for free copy.

CLEVELAND TRAMRAIL DIVISION
THE CLEVELAND CRANE & ENGINEERING CO.
3804 East 286th St. Wickliffe, Ohio

CLEVELAND TRAMRAIL
OVERHEAD MATERIALS HANDLING EQUIPMENT

(*Concluded from page 224*)

that address. Company formerly was located at 1800 Jefferson St., Anderson.

• • •

Plymouth Permanent Casting Co., 2048 Elmhurst St., Detroit, has been formed by Anthony Nyeste with capital of $50,000 to manufacture foundry castings.

• • •

Allyne-Ryan Foundry, Aetna Rd. at East 91st St., Cleveland, has awarded a $63,000 contract for a foundry addition.

• • •

Crawfordsville Foundry Co., 407 Poston Dr., Crawfordsville, Ind., plans construction of a building to house its cleaning equipment and supplies.

• • •

Timken Roller Bearing Co., Canton, O., formally opened a new branch plant May 23 in St. Thomas, Ontario, Canada.

• • •

Eldon R. Gilbert has obtained building permit for a 40 x 64 ft stucco foundry building at 1344 Coil Ave., San Pedro, Calif.

• • •

Ampco Metal Inc., Milwaukee, has appointed J. B. Ripley Brass Foundry Inc., P. O. Box 64, Windsor, Vt., as licensee to produce and sell Ampco Metal castings and stock and sell other copper-base alloy products in Vermont and New Hampshire.

• • •

Forse Corp., 601 West Thirteenth St., Anderson, Ind., recently purchased Central Brass & Aluminum Foundry, Anderson, and has moved it to the Thirteenth street address. Orville Roach has been named foundry foreman. The foundry is producing aluminum castings for Forse heaters and other products.

• • •

Williamson Heater Co., 4558 Marburg Ave., Cincinnati 9, is building a gray iron foundry at Greensburg, Ind., which is expected to be in operation by September. A. C. Buesing of the Williamson Co. has been named resident superintendent. Plans call for the foundry to employ approximately 300 men.

• • •

John Fellows and Morris Foster have opened an aluminum foundry in Valley Mills, suburb of Indianapolis. The foundry, as yet unnamed, is producing aluminum toys and job castings. Both men formerly were associated with Light Metals Inc., Indianapolis.

• • •

Sales of foundry equipment in April were 512.1 per cent of the 1937-1939 monthly average, according to the Foundry Equipment Manufacturers Association. Sales were 573.8 per cent in March and 701.2 in April, 1946.

• • •

State of Wisconsin has authorized the construction of a foundry for R. Nelson in Spooner, and foundry additions for Kirsch Foundry Inc., 125 Rowell St., Beaver Dam, and Klinsing Foundry, Ripon.

• • •

Brown Instrument Co., Philadelphia, has established a sales and service office in Baltimore. Office is at 1209 East 25th St., and W. J. Law is agent in charge of sales, assisted by J. F. Maienshein.

• • •

Rondenn Corp., Racine, Wis., has been formed to deal in all types of foundry, mill and factory supplies. Incorporators are Benjamin Waisman, J. C. Wilbershide and L. P. Baumblatt.

• • •

Thompson Foundry & Machine Co. Midlothian, Tex., has been incorporated by Lee D. Thompson, Murl R. Thompson and E. W. Hunt.

• • •

E. J. Wisterfield has obtained building permit for construction of a foundry building at 204 North Maxson Rd., El Monte, Calif.

• • •

Handi Foundries Inc., 1119 North Magnolia St., Logansport, Ind., has been formed as a general foundry business by Harry J. Dice.

YES! You can have an audit of incentive plan for a single department or your entire plant

Answering a Question
Many of You Raised
at the Detroit Convention

We will audit your operations in any one or all of the departments in your Foundry for the purpose of determining what is responsible for your present high labor costs.

In fact, we would like to tell you of an instance recently where the management of a Foundry became alarmed over the high labor costs in their Core Department and requested that we make an audit confined to just this one department.

After completing our audit and the analysis thereof, we found that much of their trouble existed in an incentive plan of payment which was badly in need of revision. Although new equipment had been installed several years ago, no effort had been made to adjust their incentive plan to compensate for these improvements. As a result, workers were being paid for work which they were no longer required to perform.

Our recommendations for rearrangement of the department, discarding of ineffectual practices, and the revision of their standards will result in a 25% saving to them in labor costs this year.

Do you have a similar problem? Can we be of help to you?

WESTOVER ENGINEERS

C. E. Westover

cv

COST CONTROL
WESTOVER ENGINEERS

Westover ENGINEERS
FOUNDRY MANAGEMENT CONSULTANTS

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Surveys Reports Layouts Cost & Production Control Systems Work Flow Charts
Wage Incentives Supervisory Incentives Plant Appraisals Operation Audits

Another NEW WAY "RAPPLESS" Core Drawing Machine for RICE BARTON CORP.

Rice Barton Corporation
Established 1857
Worcester 1, Massachusetts

April 1, 1947

Newaygo Engineering Company
Newaygo
Michigan

Gentlemen:

In answer to your letter of January 15, excuse me for not answering sooner, but this is a neglect on my part.

In answer to your question - Does the machine work satisfactorily and meets with our approval - I would say "YES". I find that it has helped us a great deal. It has added life to our core boxes, and we have gained production on some of our cores; due to the fact that when drawing them by hand, many times the cores have to be patched up, and when drawn on your core drawing machine, this patching is not necessary.

This will give you the information you were looking for.

Very truly yours,
W Byron Hagerman

WBH/md

W. Byron Hagerman
Foundry Superintendent

New Way "Rappless" Core Machine in foundry of Rice Barton Corporation, manufacturers of paper mill and textile machinery, Worcester, Mass. Repeat orders prove that they cut costs, speed coremaking.

The above letter makes a pretty complete advertisement in itself. It might be added that Rice Barton Corporation, builders of textile and paper mill machinery, has recently ordered an additional New Way "Rappless" Core Drawing Machine for their foundry . . . even more conclusive evidence of performance and satisfaction than a complimentary letter.

This simple, moderately priced machine has reduced core costs up to 55%, as is demonstrated by foundry cost cards which are available on request. Quick hand wheel adjustment permits drawing of any angle box. Ideal for two-man operation. Coremakers like them—they can get out more cores easier. Cores move through the machine continuously; no setting off of plates to one side. No special pins or grooved plates are needed on the core boxes.

Write for Full Information

NEWAYGO ENGINEERING CO.

NEWAYGO, MICHIGAN

THE New Way LINE

Sand handling, cooling and conditioning equipment, mold conveying systems, reclaiming units, rapless core drawing machines.

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ED. O'CONNOR	F. B. SCHULTZ	J. C. SOMERS	C. C. MILLER	JIM BUGLEY	S. R. VANDERBECK	H. M. WOOD	DEWEY C. HARVEY	KARL A. HERMAN
IRVING 1451	LE HIGH 1928	IRONSIDES 62-600	TYLER 53338	ELLIOT 7958	RITTENHOUSE 69288	CHERRY 2422	CHERRY 1914	8-1206

MALLEABLE FOUNDERS MARK 50th ANNIVERSARY

(*Continued from page* 79)

name to stimulate and encourage individual effort and progress in the development of the arts and sciences practiced in the malleable iron industry. Mr. Shumann accepted the award in the name of the society and announced that the presentation to the 1947 medalist would take place at the annual dinner.

H. S. Colby, executive vice president of the society, outlined briefly the wide variety of activities which engaged the efforts of the staff during the past year. These included the following: Support of OPA Industry Advisory Committee in endeavoring to make a case for price relief adequate to cover wage increases; efforts to correct the situation resulting from the government certification plan for pig iron, both at Washington and through studies of the technical staff of the society; revision of the cost manual by John Harrant, secretary-treasurer of the society, and the cost committee; efforts of Committee on Plant Operations working through staff to prepare members to meet wage and other so-called economic issues; development of the motion picture film; work of James H. Lansing, consulting engineer of the society, in behalf of Publicity and Market Development Committee; work in connection with the organization of the Foundry Educational Foundation; and many others.

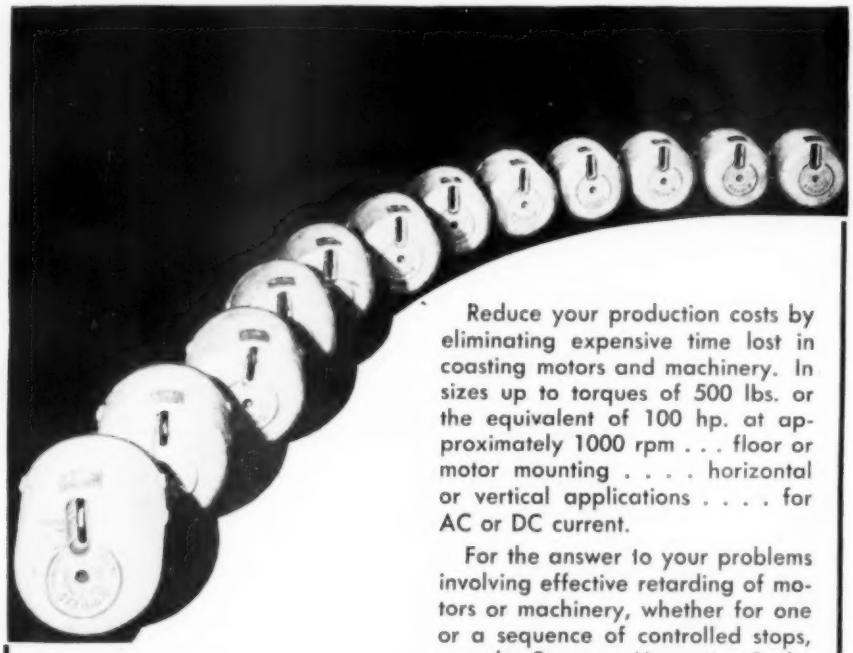
Frank E. Shumann, in his presidential address, detailed some of the problems that are facing the malleable iron industry today, and indicated certain remedies which may assist in helping the industry to meet these problems. Mr. Shumann discussed several danger signals, including the stock market, the backlog situation, the condition of inventory, and the pressure for price reduction, which now are apparent to industry. He indicated that too much complacency may prevail in connection with backlogs of orders for castings, and that storm warnings may be visible in the present price situation. While one authority has indicated that the probable fall decline in industrial activity may be about 10 per cent, a decline of that amount may mean the difference between profit and loss in many foundries. He indicated that many foundries have a very high "break even" point under present high labor and materials costs.

Recommends Remedies

As remedies, Mr. Shumann suggested greater control of costs, an active shop practice program in each foundry that will provide more efficient operations, greater attention to engineering in sales and the conversion of consumers to malleable iron castings and concentration on the human factor in the foundry business, as it pertains to foundry employees, to customers, and to the public in general. In this connection Mr. Shumann paid tribute to Anthony Haswell, James H. Lansing, and the other members of the Educational Committee, whose vision and work assisted greatly in the organization of the Foundry Educational Foundation. In his opinion, the foundation is selling the individual foundryman, through his contribution, a right to take an active personal part in the training of his successor. The money contributed goes for background only—the individual foundryman must breathe life into the products of the educational programs functioning under the sponsorship of the foundation.

Frank G. Steinebach, editor of THE FOUNDRY, discussed briefly the development and the scope of activities of the National Castings Council, and urged participation by the Malleable Founders' Society.

(*Continued on page* 230)



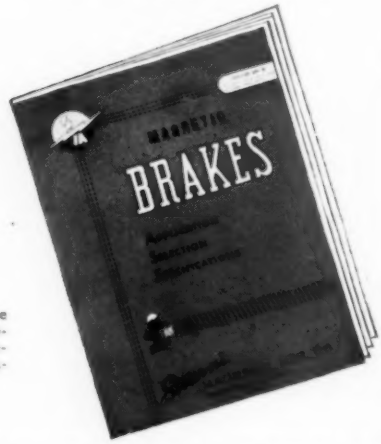
Reduce your production costs by eliminating expensive time lost in coasting motors and machinery. In sizes up to torques of 500 lbs. or the equivalent of 100 hp. at approximately 1000 rpm . . . floor or motor mounting . . . . horizontal or vertical applications . . . . for AC or DC current.

For the answer to your problems involving effective retarding of motors or machinery, whether for one or a sequence of controlled stops, consult Stearns Magnetic Brake Division, Milwaukee 4, Wis.

Ask for Bulletin 604-E.

SPEED PRODUCTION with Stearns MAGNETIC Disc BRAKES

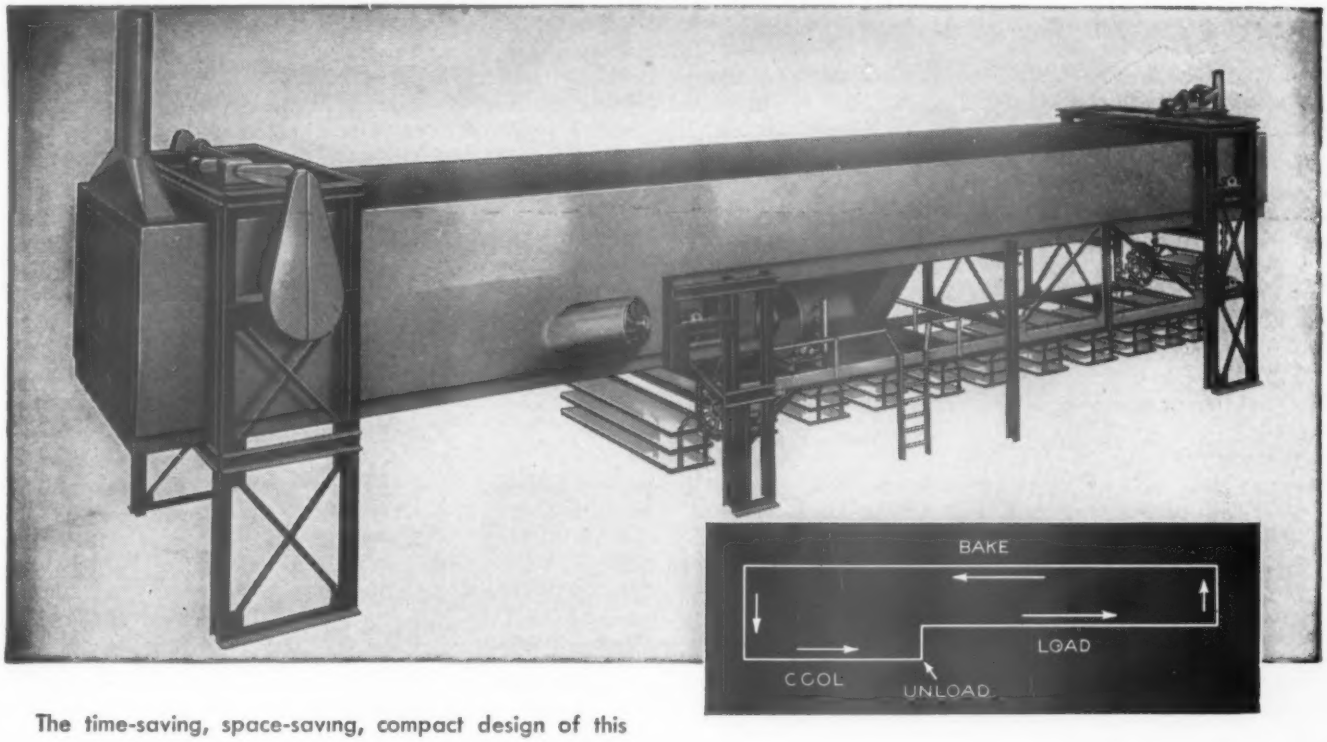
The magnetic brake with the lining wear indicator and manual release—distinctive, original.



STEARNS MAGNETIC MANUFACTURING CO.

1662 S. 28th St. Milwaukee 4, Wis.

PULLEYS—SEPARATORS—CLUTCHES—DRUMS—MAGNETS



The time-saving, space-saving, compact design of this new Horizontal Core Oven is characteristic of Young Brothers' Engineering. Into it went the skill and confidence of many years of experience . . . also a thorough knowledge of the job to be done and the production problems involved.

This new core oven can be installed in practically any building without making any major structural changes.

The coremakers are located right next to the oven so that they can load the cores directly on the moving racks thus eliminating the necessity of transporting them on hand trucks or a conveyor from the core room. The location of the coremakers, at the oven, also saves core room space.

The size of the loading racks can be varied and the shelves can be adjusted to accommodate cores of many sizes and shapes.

Besides allowing for the removal of exhaust gases at the point of greatest concentration, the new oven design provides an effective cooling zone for the cores and assures comfortable working conditions for the coremakers.

This New Horizontal Core Oven is Young Brothers' answer to the demand for better core baking equipment. It is YOUR answer to the need for lower production costs and higher operating efficiency.

New HORIZONTAL CORE OVEN . . . . . offers many cost saving advantages!

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YOUNG BROTHERS COMPANY

6508 MACK AVENUE DETROIT 7, MICHIGAN

ESTABLISHED IN 1896

(*Continued from page* 228)

The annual banquet featured the presentation of the Charles H. McCrea Gold Medal of the society to George E. Bean, managing director, Eastern Malleable Iron Co., Wilmington, Del., and the recognition of John T. Llewellyn, chairman of the board of the Chicago Malleable Castings Co., as the only living member of the original group of 14 who 50 years ago started the American Malleable Castings Association, the predecessor of the Malleable Founders' Society.

Paul H. Vincent, Erie Malleable Iron Co., and a member of the awards committee, described the contributions of Mr. Bean to the malleable industry, placing special emphasis on his work as the chairman of the Malleable Castings Handbook Committee, one of the most important recent activities of the society. In accepting the award from President Shumann, Mr. Bean paid high tribute to the outstanding contributions of all members of the Malleable Castings Handbook Committee.

Cal C. Chambers, president, Texas Foundries Inc., Lufkin, Tex., told the banquet audience that 50 years ago 14 malleable iron manufacturers met in New York to discuss the possibility of forming a trade association in the industry. Those in attendance were as follows: William B. Earnshaw, Dayton Malleable Iron Co.; E. C. Felthousen, Acme Malleable Iron Co.; Fred Frazer, Frazer & Jones Co.; G. H. Graham, Oriskany Malleable Iron Co.; O. P. Letchworth, Pratt & Letchworth Co.; John T. Llewellyn, Belle City Malleable Iron Co.; E. C. Metcalf, Westmore Malleable Iron Co.; Joseph Metcalf, Erie Malleable Iron Co.; R. C. Oliphant, Trenton Malleable Iron Co.; W. H. Osborne, Wisconsin Malleable Iron Co.; Frederick Silvyer, Northwestern Malleable Iron Co.; Amos Whitely, Whitely Malleable Castings Co.; John A. Penton, THE FOUNDRY, who acted as secretary, and a representative from the Arcade Malleable Iron Co.

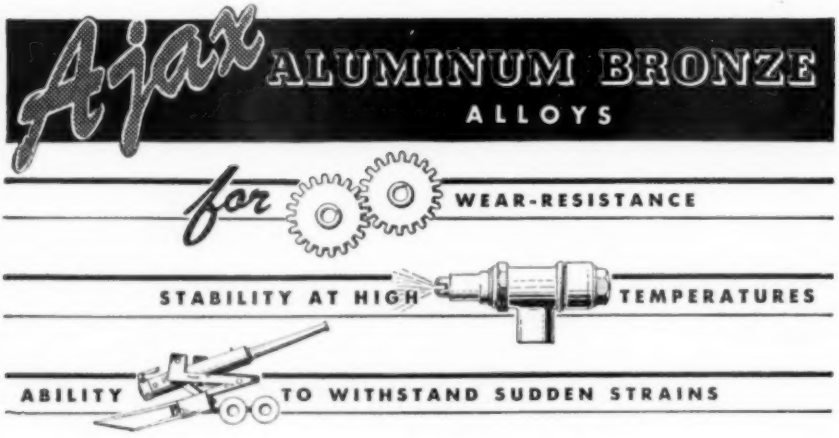
This first meeting was followed by a second in Buffalo a short time later, where the American Malleable Castings Association was formed. In 1927 the organization was changed to the Malleable Iron Research Institute, and this in turn became the Malleable Founders' Society in 1934.

Descendants Are Active

Mr. Chambers pointed out that two sons and four grandsons of the original charter members are now active in the industry. These include William Osborne, president of Lakeside Malleable Castings Co., Racine, Wis., and his two sons, Robert and Lucien; Francis Metcalf, president of Westmoreland Malleable Iron Co., and his son Elliott; and John T. Llewellyn II, vice president of Chicago Malleable Castings Co.

The society then paid affectionate and respectful tribute to the only surviving member of the original group of 14 that started the American Malleable Castings Association—John T. Llewellyn, chairman of the board, Chicago Malleable Castings Co., who was present at the banquet. Mr. Chambers introduced Mr. Llewellyn as "the man whose enthusiastic support, wise counsel and sound advice have been such a great inspiration and help to succeeding generation of malleable men during the past 50 years—the grand old man of our industry."

Mr. Llewellyn described the characteristics of each of the founders, and told about the first annual dinner for which the hotel used its renowned gold table service. He said the organization fairly represented the leading manufacturers of the East and Middle West, and that perfect harmony prevailed during the two-day meeting. At that time, according to Mr. Llewellyn, rule of thumb methods caused heavy losses in rejected castings. With low prices and high costs prevailing, the industry was in need of a doctor—



Investigation of Aluminum Bronze Alloys is warranted by foundrymen and designers where metal parts are subjected to either recurrent stresses or compressive forces and resistance to fatigue is sought; where the ability to withstand high temperatures or, where a high degree of corrosion resistance to many chemicals may be a significant factor in material selection. Supplied by Ajax in alloyed compositions of copper, aluminum and iron, as well as special alloys containing nickel and manganese, a complete selection of Aluminum Bronzes is available to meet all existing specifications as listed by Non-Ferrous Ingot Metals Institute, ASTM and the Federal Government.

Ajax, in adhering to its policy pioneered in the very infancy of the non-ferrous metal industry, exercises the closest scientific control over the production of these alloys. Metal men may look to Ajax with continued confidence not only for supply of highest quality Aluminum Alloy ingots, but also for practical technical know-how on correct foundry practice for producing better castings with fewer rejects. Request booklet "Ingot Metals of Today".

Standard Ajax Metals

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Ajax Plastic Bronze
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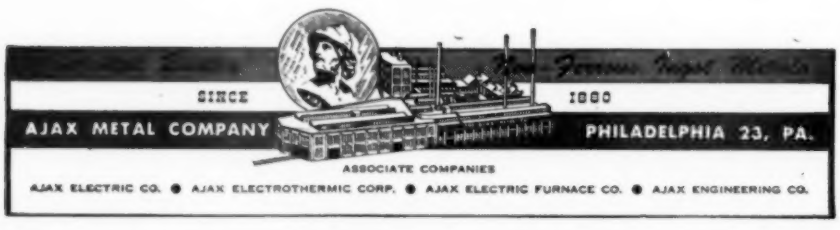
Ajax Golden Glow Yellow Brass
Ajax Nickel-Copper 50-50%
Ajax Manganese Copper
Ajax Aluminum Alloys
Ajax Phosphor Copper
Ajax Silicon Copper
Ajax Nickel Alloys
Ajax Phosphor Tin


SINCE 1900
AJAX METAL COMPANY
PHILADELPHIA 23, PA.
ASSOCIATE COMPANIES
AJAX ELECTRIC CO. ● AJAX ELECTROTHERMIC CORP. ● AJAX ELECTRIC FURNACE CO. ● AJAX ENGINEERING CO.

a metallurgist. He stated it is a revelation to look back and compare today's many advances in malleable practice with the methods of operating 50 years ago.

At the session on the second day, Mr. Shumann, retiring president, introduced Collins L. Carter, president and general manager, Albion Malleable Iron Co., Albion, Mich., and vice president-elect of the society, who presided. Wilson H. Moriarty, vice president, National Malleable & Steel Castings Co., Cleveland, and president-elect of the society, did not reach the meeting until late because of a train breakdown.

The entire session was devoted to reports of the various committees of the organization. John J. Harant, secretary of the society, presented the report of the Budget and Finance Committee which indicated that the organization is in a healthy financial condition.

Provide Program for Year

Cal C. Chambers, chairman of the Program Committee, indicated the desirability of again providing the program for the entire year before the first fall meeting. This system worked quite successfully last year. George J. Behrendt, Eastern Malleable Iron Co., reporting for the Plant Operations Committee, stated that a number of successful meetings had been held during the past year by both the eastern and western sections, dealing with job classification, job evaluation, and labor relations.

Ralph N. Cole, president, Canton Malleable Iron Co., Canton, O., reporting for the Cost Accounting Committee, discussed the extent to which the new cost manual is being put into use by member companies. Mr. Cole stressed the need for greater uniformity in the cost practices of the industry. Mr. Cole also reported for the Research and Product Improvement Committee and stated that 12 shop practice meetings were held during the year. A new series is planned starting in July. He also outlined the work of the society's laboratory, the contacts made by the consulting engineers and others with various engineering societies, field calls and the work of the shop practice engineers, and other activities.

James H. Lansing, in reporting for the Technical Council, discussed the various projects dealing with such factors as test bars, grinding wheels, annealing practices, and physical properties of malleable iron, which were studied during the year. He presented briefly a report on "Comparison of Annealing Practices" which was undertaken in 24 different plants, using a low carbon and a high carbon iron. With charts he showed comparisons of oven and pot temperatures and indicated that is was very important to make such comparisons on each individual oven before establishing practices.

Frank O. Parker, sales manager, Dayton Malleable Iron Co., Dayton, O., presented the report of the Publicity and Market Development Committee. He indicated that malleable iron is better known today than ever before, and this is probably due to the fact that malleable castings were used very extensively during the war. He discussed the various activities which are serving the industry and its members, including the publication "Malleable Iron Facts"; the technical display cabinets which are being installed in many engineering schools; the contacts with engineering schools which include lectures, discussions with professors and participation in regional conferences; activities in many other engineering societies; engineering papers, the Malleable Handbook; the "Malleable News Letter," and the motion picture which is now underway.

James H. Smith, manager, Central Foundry Division, General Motors Corp., reported for the Education Committee and paid tribute to the work of Anthony

AJAX
TAMA-WYATT

IS MAKING NEWS BY ELECTRIFYING THE ALUMINUM ALLOY INDUSTRY

ACCURATE CONTROL FOR MASS PRODUCTION OF PRECISION PARTS IN AJAX ELECTRIC MELTING FURNACES

THE aluminum foundry has long needed an induction furnace suited to continuous high output. AJAX Tama-Wyatt Induction Melting Furnaces are being extensively installed by nationally known manufacturers like the Johnson Motors Division of the Outboard Marine & Manufacturing Co., in their new all-electric die casting plant at Waukegan, Ill., U.S.A.

Photos Courtesy "Electrified Industry"

A large number of aluminum die castings are used in the manufacture of outboard motors. The more precisely these castings meet standard specifications for size, strength, quality and weight, the lower are overall production costs. AJAX Tama-Wyatt Induction Melting Furnaces contribute to the uniformly high efficiency of the Johnson plant and to the quality of their castings.

For the first time in industrial history this die casting plant is using electric furnaces exclusively to melt and hold metal to be processed in die casting machines.

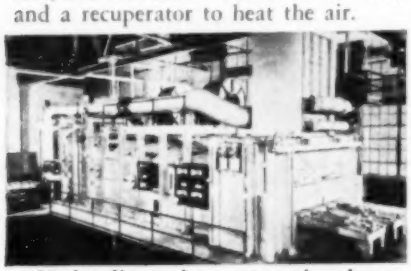
AJAX ENGINEERING CORPORATION, Trenton 7, N. J.

R-S Furnace Facts

FOR THOSE CONCERNED WITH QUALITY HEATING OF METALS

Looks Efficient...and it IS!

Pic shows an R-S Continuous Wire Bar Heating Furnace at the Hawthorne Plant, Western Electric Company. Oil-fired for controlled operation at 1700°F. Ten burners at the discharge end; five over and five under the billets, and a recuperator to heat the air.



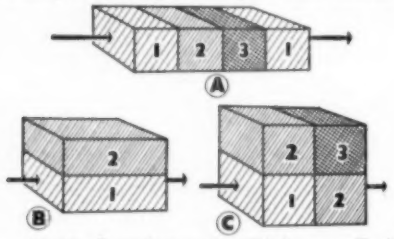
Hydraulic pushers move the charge into a heating-chamber 12' 3" wide and 38' long. Capacity is 60,000 lbs. per hour. This R-S Furnace, installed in 1930, is typical of the long life, low upkeep, and high productiveness of R-S Furnaces.

A cost-conscious heater in Lee
Had learned that M equals 3P*.
Said he in conclusion,
First cost's a delusion,
R-S is the furnace for me!

*"M" (for maintenance) is 3 times as high as "P" (for profits) according to AISE figures for the entire steel industry. R-S Furnaces have built their repute on low maintenance—in many cases literally NO maintenance—over a period of years.

3-Way Furnace Zoning

"A" shows lengthwise zoning as used in many furnaces for establishing time-temperature cycles (continuous or step-work) and compensating for end-losses.



Vertical zoning as in "B" is rare. R-S engineers find it heats faster and gives more uniform temperatures with large charges, either batch or continuous. Combination zoning, in "C", is seldom called for, but when it is needed you can be sure that R-S engineers think vertically as well as horizontally. JMLCo P-F1

FURNACE DIVISION
R-S Products Corp.
PHILADELPHIA 44, PA.

Haswell in the formation of the Foundry Educational Foundation. Mr. Smith outlined the purposes of the foundation, explained that contributions are suggested on the basis of a dollar per year per employee for three years, and requested the financial support of the members of the society in the project.

Mr. Shumann reported for the Committee on Government Regulations and Controls and outlined the extensive work of this group during the past year in helping the industry to operate under the regulations instituted by government. He reported that at present the committee is inactive but is standing by in case of future need.

In closing the meeting, Mr. Carter expressed the appreciation of the Malleable Founders' Society for the excellent work of Frank E. Shumann as president of the organization during the past year.

PLASTIC PATTERNS

(*Continued from page* 89)

Fig. 1 shows typical 36 x 36 in. plastic cope and drag pattern sections. Fig. 2 shows two plates which have produced over 4000 molds for steel castings. Fig. 3 is a view of two matchplates used by an aluminum foundry and shows castings which have been produced from molds made by one of the plates. Fig. 4 shows two new plastic matchplates. The aluminum frames with plastic inserts can be seen.

Manufacturing process in making plastic patterns is comparatively simple. In the case of matchplates, a plaster mold is made of the customer's original wood pattern. The face of the mold containing the pattern impression is made smooth and level so that a precision ground, parallel cast aluminum channelled frame with integral ears may be placed between the two halves of the mold to take the plastic insert. Sections of the frame which come in contact with the mold are coated with a cement to form a pressure-tight seal. The mold, held together with clamps, is placed in one of the curing ovens where special equipment forces the plastic mix into the mold under pressure of 40 to 120 psi, depending on the size and design of the pattern being made.

The plastic mix enters the mold through a tube screwed into a threaded opening in one edge of the aluminum frame, and entrapped air is exhausted through a similar opening at the opposite end of the frame. In this casting process the aluminum plate held between the halves of the mold becomes an integral part of the matchplate.

These frames provide a means for attaching the pressure feeding equipment; they also protect the edge of the plastic pattern from damage, provide standard size matchplates, and simplify production of the plates.

After being poured the plastic must be cured before the patterns can be used. The curing process is accomplished by external heat of induction to drive off volatiles from the plastic mix. Time and temperatures for curing vary with the type and size of the pattern being made. One of the matchplates made by the company with section thicknesses up to approximately 8 in. was cured at 140 F for 6 hr, 150 F for the next 8 hr and 170 F for 4 hr—a total curing period of 18 hr.

The company has two gas-fired recirculating ovens and a battery of infra-red bulbs which are used for curing. The gas ovens are similar to core baking ovens.

After curing, the patterns are removed from the molds and generally are ready for immediate use. Ordinarily no clean-up of any kind is necessary, although in the case of some patterns they are buffed to enhance their glass-like surface. If some patterns do require a small amount of grinding or other finishing of any kind, it can be done in 2 or 3 hr.

The plastic mix consists of a liquid phenol formaldehyde thermosetting resin, a catalyst to stimulate the exothermic heat reaction which controls curing of the resin, and a filler used to increase impact strength of the solidified resin. The plastic must be poured at once after being mixed because it immediately starts to solidify.

Because of the low shrinkage qualities of the plastic during solidification it is well adapted to the manufacture of single shrink patterns. Shrinkage is approximately 0.0025 in. per in. in actual laboratory test bars. Where critical dimensions must be held, shop techniques have been developed to hold shrinkage to an absolute minimum. This factor adapts the plastic to the duplication of single shrink, gated patterns, duplication of broken aluminum matchplates, reconversion of metal plates or, for that matter, to any part where minimum shrinkage is essential.

When making plastic matchplates, flat-backed or unmounted patterns, plaster is the commonest molding material, although sand and plastic sometimes are used. When sand is employed it is usually an intermediate step in the production of a plaster mold, particularly when irregular parting lines are required. In this case the pattern to be duplicated is placed on a board of the proper size and is supported where necessary to keep it from rocking. A rectangular wood frame is placed on the board around the pattern. Depth of the frame is no greater than the space between

the board and the lowest contour of the pattern parting line.

A fine grade of molding sand is poured around the pattern, hand rammed and built up from the top of the frame to the parting line on the pattern. A flask of the same dimensions as the frame is placed on top of the frame, and the pattern is coated with a parting compound. Plaster then is poured in to make half of the mold. When the plaster has set, the half-mold is removed and placed with the cavity side up and the master pattern placed in it. Pattern and surrounding surfaces are coated with parting compound and the other half of the plaster mold is made.

Completed plastic patterns are pale yellow in color. The plastic, however, may be dyed black, dark brown, light brown, red, orange, deep yellow or blue. The entire pattern or certain portions of it may be colored as a signal to the molder to indicate core prints, for instance.

Presents Several Advantages

Several advantages are claimed for plastic patterns. Drawing qualities are good because of the glass-like smoothness of the finished surface and because thermal reaction with hot sand does not occur. The plastic is a nonconductor of heat, thus condensation on the plate is avoided. Less vibration is required for drawing, and better molds result from the easier draw.

Physical properties of cast plastic are:

Impact strength, 1 ft-lb as calculated by the standard ASTM Izod test.

Specific gravity, 1.7.

Water absorption, 0.4 per cent in 24 hr.

Compressive strength, 16,000 psi.

Rockwell hardness, 115 on the R scale.

Shrinkage, 0.0025 in. per in.

Flexural strength, 10,000 psi.

Temperature range, 340 F and no limit on the low side. Above 340 F the plastic would craze.

The plastic can be drilled, tapped, jig-bored, sanded, scraped, milled, etc. It is impervious to water, acid and oils. The material has considerable durability, but it will chip if struck a sharp, glancing blow. Such a chip or other damage may be repaired with a patching material which handles like modeling clay, forms a virgin bond with the original pattern and will dry in 24 hr at room temperature. Under an ordinary infra-red lamp it will dry in 20 minutes. When dry, the patching material may be sanded and worked with tools the same as the original plastic.

Sources of Illustrations

Fig. 1—Howard Foundry Co., Chicago.
Fig. 2—Crucible Steel Castings Co., Milwaukee.
Fig. 3—Chicago Aluminum Castings Co., Chicago.
Fig. 4—Massey Harris Co., Racine, Wis.

THREE STEPS TO BETTER CASTINGS
with ASBURY GRAPHITE PRODUCTS:

KLEEN-A-KAST
an outstanding shake-on facing

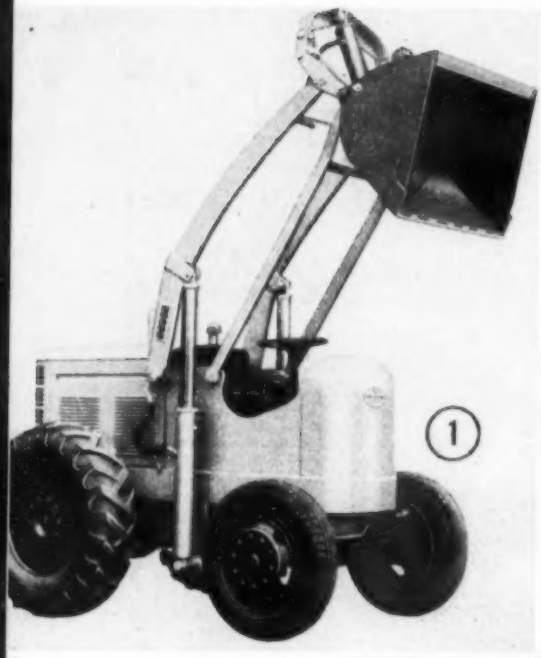
PLUMBAGO
CORE WASH
Better Finish — Easier Cleaning

PIPE REDUCER
CARBON & NON CARBON

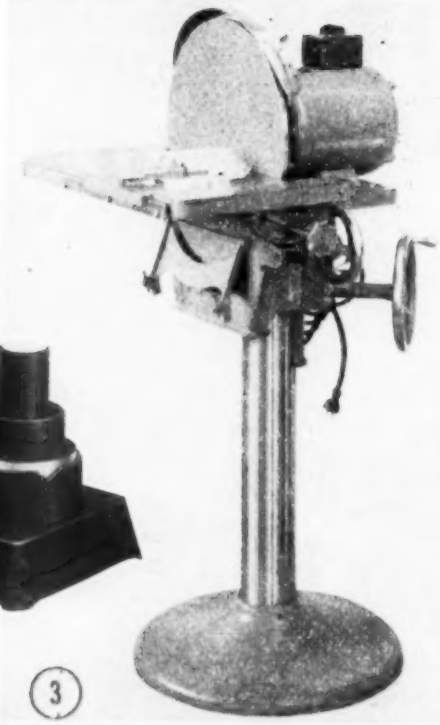
The Asbury Graphite Mills, Inc.
MAIN OFFICE & WORKS
ASBURY, NEW JERSEY

New Equipment and Supplies

(1)—Shovel: Frank G. Hough Co., 703 Sunnyside Ave., Libertyville, Ill.—Medium size shovel of ¾-yd capacity has four-speed fully reversible transmission providing forward digging speeds plus high reverse maneuvering speeds, all available with a minimum of shifting. Bucket is raised, lowered, dumped and relatched by hydraulic power, controlled by one lever and may be dumped completely or gradually at any height. Spillage of loose materials is minimized by means of an automatic bucket tip-back. Tractor has automotive type steering and hydraulic brakes. Extra equipment available includes a bulldozer blade, crane hook, cab and snow bucket.

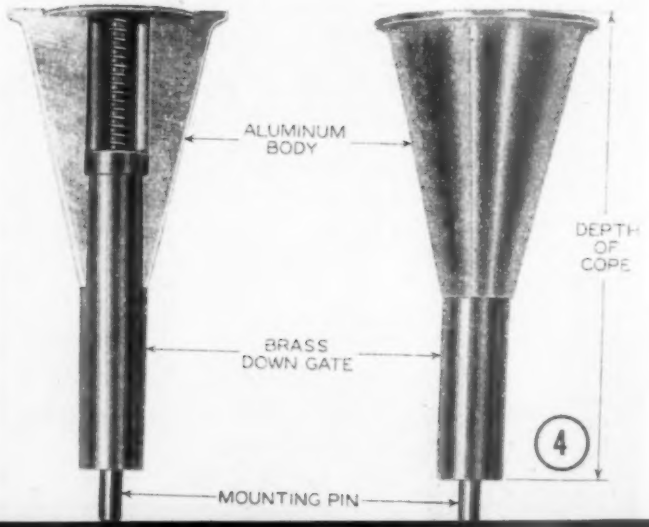


(2)—Permeability Control: Harry W. Dietert Co., 9330 Roselawn Ave., Detroit 4—Particularly adapted to determining the permeability of foundry molding materials, this instrument has a direct reading meter which measures the air flow through specimens of any material. An automatically operated electric timer unit, driving a circular dial reading in cubic centimeter air flow per minute at one gram pressure, is employed with a gasometer unit. Movement of the gasometer bell automatically starts and stops the timer unit when a given quantity of air or gas is passed through the test specimen. The instrument performs all of the necessary timing and calculations.

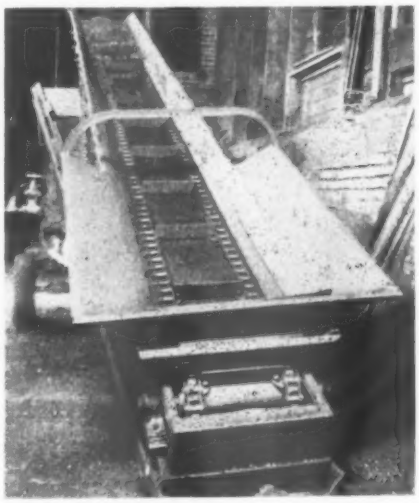


(3)—Sander-Grinder: R. E. Darling Mfg. Co., 8681 Madison Ave., Southgate, Calif. — Disk sander and grinder is suitable for sanding wood and plastics and for grinding metal. Disk is 16 in. diam; table is 10¼ x 22½ in. and is tilted 45 degrees in either direction and raised and lowered by hand wheels and worm gears. Squaring bracket facilitates squaring table after it has been tilted. Standard equipment includes two steel disks, miter gage, ¾-hp ball bearing motor (single or 3-phase) and tilt-back guard. Dust removal equipment may be attached to the guard.

(4)—Sprue Maker: Federal Foundry Supply Co., 4600 East 71st St., Cleveland 5 — Sprue-making device known as the Shur-Spot sprue, is adapted readily to existing gated or plated patterns. A ¼-in. hole is drilled in the pattern gate or runner at the spot where the pouring sprue is usually cut. Pin on the end of the sprue-making device fits into that hole and is inserted before the molder adds sand to the cope. The sprue-making device squeezes down with the sand when the cope is squeezed in the regular way. When the squeezer board is removed, the device pops up and may be lifted out. Standard squeeze depth of the device is 1½ in. but can be furnished up to 2½ in. Standard down gate diameters are ½, ⅝, ¾, ⅞ and 1 in. Top diameter of the aluminum body is 2½ in.



Conveyor: Material Movement Industries, 310 South Michigan Ave., Chicago 4—Portable flight conveyor will convey such materials as sand, coal, dirt, ashes, pig iron and small castings at inclines up to 45 degrees. Power is furnished by an electric motor or gasoline engine which will handle up to 60 tons per hr of 50 lb per cu ft material. Conveyor is available in two models—14-ft and 20-ft lengths with



discharge heights of 10 and 14 ft, respectively. Minimum discharge height of both models is 4 ft. Flight speed is 100 fpm. Conveyor comes mounted on a combination trailer and hydraulic lifting device for easy moving from one job to another and for quick adjustment of conveyor angle.

Ear Defenders: Mine Safety Appliances Co., Braddock, Thomas & Meade Sts., Pittsburgh 8—Ear defenders exclude excessive noise but permit speech and warning signals to be heard. They are tapered tubes molded from a soft, nontoxic, elastomeric material with an inner septum for filtering harmful noises. Inner end of the tube has a soft, resilient flange which provides a comfortable fit and complete closure of the ear canal. An outer flange prevents it from entering the ear too far. They are comfortable to wear, sanitary and easy to insert and remove.

Electrode: McKay Co., 1005 Liberty Ave., Pittsburgh 22—Direct current, reverse polarity arc welding electrode provides weld metal which is highly resistant to impact or abrasive wear in hard surfacing applications. The weld metal, as deposited, tests 59.0 Rockwell "C" hardness and is capable of being heat treated for machining or grinding, and subsequently reheat treated to restore it to its as-deposited hardness. Underbead cracking on hardenable steels

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is at a minumum and the weld metal fuses readily with the base metal. Electrode is available in five sizes from 3/32 to 1/4 in.

Grain Refiners: National Smelting Co., 6707 Grant Ave., Cleveland 5—Three new grain refiners are said to add powerful grain refining elements to aluminum alloys in addition to affording good cleaning action. It is claimed that their grain refining action has been effective in decreasing shrinkage and hot shortness in both sand and permanent mold aluminum castings and in eliminating areas of varying grain size which cause shrinkage porosity in aluminum castings.

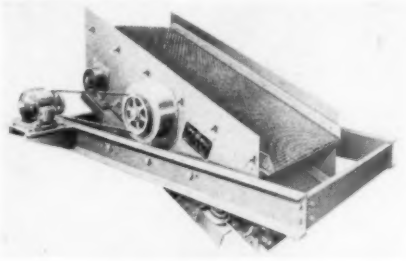
Air Valves: Lindberg Engineering Co., 2453 West Hubbard St., Chicago 12—Hand operated air valves, utilizing the balanced piston principle, have no linkage or mechanical connections be-

tween pistons and operating lever. Pistons are held in position by air pressure. Made of cast alloy aluminum with inner parts of stainless steel and bronze, this three-position lever, four-way valve is designed for 175 lb maximum working pressure and long trouble-free service.

Solder: All-State Welding Alloys Co. Inc., 96 West Post Rd., White Plains, N. Y.—Cast iron solder rod produces corrosion-resistant welds in cast iron which must be water-tight and pressure-tight up to 1000 psi. It is also used for sealing and filling cracks and blowholes and for building up where strength is not required. Solder melts at 600 F and tins easily.

Grinding Wheel: Carborundum Co., Niagara Falls, N. Y.—New type ceramic or vitrified bonded grinding wheel contains a new blend of abrasive grains properly bonded to give optimum results in grinding. In construction of the wheel, factors that interfere with cutting action have been reduced and factors contributing to higher cutting efficiency have been increased. As a result of the extensive field testing performed to date, a narrow pattern of grits and grades has been developed which will cover a wide range of operations. The wheel, known as Series 20, is particularly useful for tool room service.

Screen: Link-Belt Co., 307 North Michigan Ave., Chicago 1—Vibrating screen can be used for both medium and heavy duty sizing of a large variety



of materials as well as for scalping and watering or rinsing operations. Screen is inclined floor-mounted (as shown here) or spring and cable suspended and has a balanced two-bearing vibrator mechanism which imparts a concentric or circular vibrating motion to all points of the screening surfaces. It is made with double or triple decks and in sizes ranging from 3 x 8 ft to 6 x 14 ft. Single deck screens can be provided by removing the lower deck of the standard double deck screen.

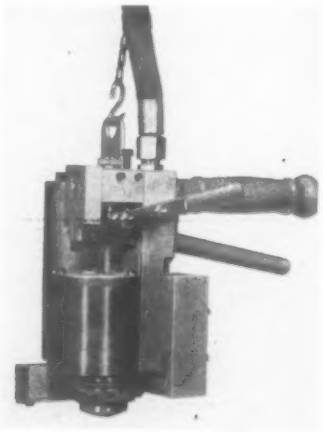
Hand Truck: Ace Co., 12-40 North Orange St., Ocalo, Fla.—Steel tube hand truck is designed so that the thrust from the load is carried directly from the nose plate to the frame and

not through a welded joint. Nineteen models of varying sizes are available with solid rubber or semipneumatic wheels and capacities from 350 to 750 lb. Model shown here is designed for

rough going, over curbs, car tracks, etc. It is equipped with 10 x 2.75 in. semipneumatic wheels, has a capacity of 750 lb, is 51 in. high, weighs 40 lb and can be supplied with either flat or concave crossbars.

Refractory Gun: Basic Refractories Inc., 845 Hanna Bldg., Cleveland 15—Gun is designed to apply air-emplaced refractory materials to vertical and semivertical furnace brick walls and to accomplish certain types of steel furnace repairs. It is equipped with a pressure hopper designed to hold 500 lb of refractory weighing 140 lb per cu ft, has a discharge capacity of more than 100 lb per minute and automatically wets the refractory shortly before the point of discharge.

Metal Sprayer: Metaloy Sprayer Co., 135 Liberty St., New York 6—Metal spray gun that melts and



sprays low melting temperature alloys is a self-contained precision type sprayer which can be used for either intermittent or production spraying and is designed to provide close control of the amount and character of the spray. Applications for the sprayer are found in the precision casting field, coating wood patterns and coreboxes, production of molds for the lost wax process and making dies and molds. Intermittent spraying without emptying the pot during off periods is possible. Metal in stick form is inserted in the pot through the guide ring and feeds down as it melts. Metal can also be inserted in the gun by using ladle and funnel.

Respirator: Mine Safety Appliances Co., Braddock, Thomas and Meade Sts., Pittsburgh 8—Respirator provides breathing protection against every type nuisance or harmful dust encountered in industry. It consists of a formable aluminum face piece with adjustable elastic headband and transparent plastic filter container. Easily changed, throwaway-type filters are obtainable in two types—

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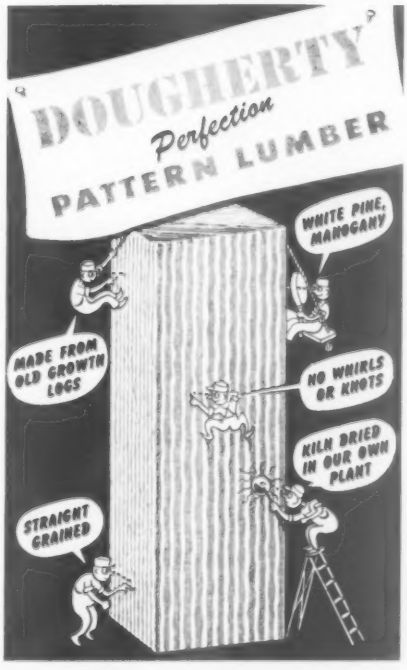

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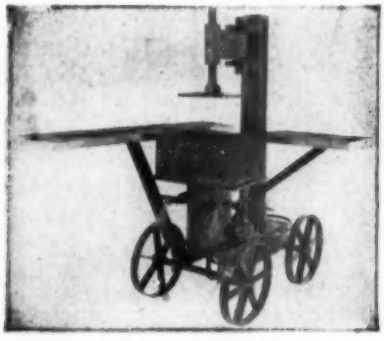

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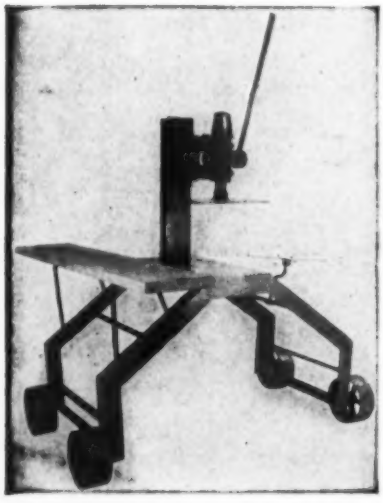

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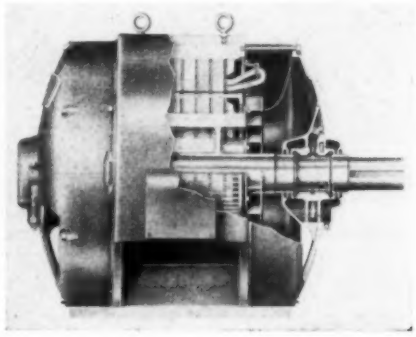
for pneumoconlosis-producing and nuisance dusts and mists, and heavy dust concentration; and for toxic dusts such as lead, cadmium and manganese.

Core Oil: Alox Corp., 3231 Buffalo Ave., Niagara Falls, N. Y.—Consisting of a mixture of oxygenated hydrocarbons derived from petroleum, this oil, when blended with sand in the ratio of 1 part oil to 40 parts core sand and baked for 2 hr at 400 F, produces a strongly bonded sand core. The oil is said to form no gas at the temperature of molten castable metals and to provide the core with good collapsibility.

Motors: Electric Machinery Mfg. Co., 1331 NE Tyler St., Minneapolis 13—Heavy duty squirrel-cage induction motors for power drives from 100 to 1000 hp, 1800 rpm and lower speeds are drip and splash-proof. Fabricated steel frame shuts out falling particles, makes operation quiet and cleaning easy. In-



spection and blowing out is simplified by access plates on the larger rated motors. Sealed bearing can be cleaned and refilled without motor disassembly. Double end ventilation is provided by a blower on each end of the rotor. Starting characteristics are NEMA Class B. (normal torque, low starting current) for across-the-line starting.

Battery Charger: Motor Division, General Electric Co., Schenectady, N. Y.—Battery charging equipment for industrial truck service consists of a single circuit battery charging motor-generator set with control cabinet mounted on a welded steel framework. Charger is automatic and charges the battery at the exact tapered charge rate recommended by the battery manufacturer.

Electrode: Wilson Welder & Metals Co. Inc., 60 East 42nd St., New York 17—All position electrode with a high nickel core wire and heavy extruded coating has application wherever an electrode is used on cast iron. Because of high nickel content, welds, when properly made, will be machinable, free from cracks and porosity and will exhibit adequate tensile strength and ductility for cast iron welding. It is available in 5/32, ⅛ and 3/32 in. diam and may be used on either ac or dc.

Goggle: American Optical Co., Southbridge, Mass. — Spectacle type safety goggle has acetate frame providing a more exact fit, increased comfort

and good appearance. The light weight goggle has a key hole bridge which is strong and sturdy, has a slight amount of face form for added comfort. In addition to comfort cable temples the goggle is available with skull temples which consist of a strong wire core encased in acetate. It comes with either six-curve clear or calobar super armorplate lenses.

Glove: Riegel Textile Corp., 342 Madison Ave., New York 17—New type work glove carries a guarantee that it will outwear any other canvas work

glove. It is soft and flexible and has a nonslip surface that facilitates gripping and increases protection.

Compressor: Cooper - Bessemer Corp., Mount Vernon, O.—Offering good space saving possibilities compared with other big scale industrial installations, this compressor can be driven by electric motor, engine or turbine. Provision can be made for low vacuums or high pressures, as well as for all intermediate pressures in handling air or gas. It is

available in six sizes and in horsepowers from 500 to 2750. Dimensions range from 11 ft, 7 in. to 24 ft, 6 in. in length, and from 13 ft, 9 in. to 24 ft, 2½ in. in width.

Cleaners: Air Reduction Sales Co., 60 East 42nd St., New York 17—Tip cleaners for cleaning oxyacetylene welding and cutting tips are available in two individual packages. Set 1 contains 12 cleaners for drill sizes from Nos. 75 to 49. Set 2 contains 9 cleaners for drill sizes from Nos. 48 to 30. Cleaners are made of corrosion resistant stainless steel and each set comes in a leather case.

Light Fixture: Midwest Lighting Products Co., 1357 Beach Parkway, Cleveland—Lighting fixture, adaptable for low or high bay lighting, has hermetically sealed silvering in double walled glass reflector which cannot peel and is unaffected by different at-

mospheres. Reflector can be cleaned easily with any cleaning solution without removing from fixture. Housing is aluminum and all parts are cadmium plated to resist rust. Fixture is available in two sizes—one for 200, 300 and 500-w lamps, the other for 750-w incandescent or 400-w mercury lamps.

Electrodes: Ampco Metal Inc., 1745 South 38th St., Milwaukee 4—A new shielded-arc coating has been developed for five grades of the company's aluminum bronze electrodes. These rods are said to strike easily and do not "snuff out" on ac welding. Spatter loss has been reduced and the manipulative characteristics have been improved for welding with reverse polarity direct current. These electrodes are recommended for use in welding cast irons, malleable irons, aluminum bronzes, silicon bronzes, some nickel alloys, and dissimilar metals with alternating current transformers having a 75-85 open circuit voltage and direct current generators.

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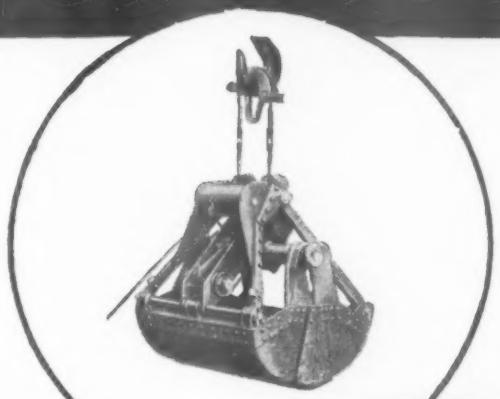

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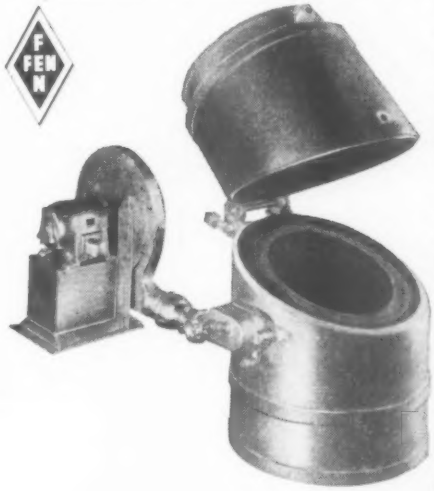

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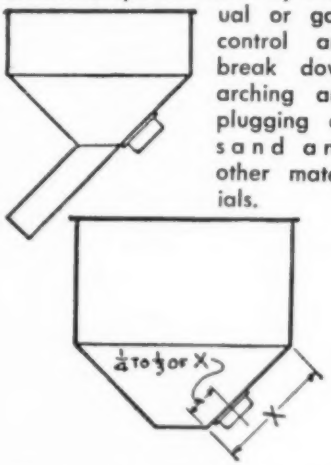

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SYNTRON CO.

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NEW AUTOMOTIVE FOUNDRY

(*Concluded from page* 85)

corn flour, brick and other supplies are brought in on a separate track to the supply storage building. They are unloaded opposite an elevator which carries supplies to the second and third floors.

Mechanical equipment charges raw materials into the cupolas. A 5-ton bridge crane with electromagnet lifts steel, pig iron and scrap into a weigh car beneath the first floor. Coke and limestone from overhead bins are added. The charge is then dropped from the weigh car into a skip hoist. The hoist rises from the basement to the charging area, where it automatically unloads into the cupola. With this equipment one cupola can be charged by two men —a crane operator and a weigh car operator.

When the cupola is tapped the metal runs continuously into a holding ladle. Electric crane ladles on a monorail carry the molten iron to pouring stations on the molding floors. These crane ladles can be filled from the holding ladles without plugging the tap hole of the cupola.

Equipped With Sand System

Cylinder crankcase molds are poured directly from the electric crane ladles. Molds produced on three other conveyor lines are poured from hand ladles.

Each of the four molding conveyor lines—cylinder block, small hard iron parts, large soft iron parts and small soft iron parts—is equipped with separate sand system. This provides sand most suitable for the type of casting made on each line. Sandslingers are used on both hard iron lines and jolt squeeze roll-out machines are used on the soft iron lines. All molds are handled by overhead hoists.

Cylinder crankcases and transmission case castings are transported from shakeout by monorail to the cleaning room. Cylinder crankcases go through a stress-relieving furnace, allowing all sections of the castings to cool uniformly.

Other castings are sent across a mechanical shakeout and are automatically unloaded into an oscillating conveyor, which carries the castings to a cooling conveyor in the cleaning room. The cooling conveyor allows the castings to cool as it delivers them to a mechanical shakeout, which removes excess sand before dropping the castings onto a vibrating screen. The screen removes fins and light pieces of metal.

In the next operation the castings automatically enter a wet tumbling mill and are tumbled for 59 ft. This removes sand left on the castings and furthers the cleaning process. Emerging from the tumbling mill, the castings are automatically deposited on a slat conveyor, where they are sorted into containers through individual chutes. Here gates and sprues are removed and placed on a bucket monorail for delivery to scrap metal bins.

The castings are more easily handled than in the past because they are cooled by the wet tumbling.

After sorting, the castings are put through an airless blast unit and then continue on their way to grinding and inspection lines. After grinding and careful inspection, the castings are ready for shipment.

ELECTRONIC CORE BAKING

(*Continued from page* 69)

collapsibility characteristics. When the casting reaches the shakeout, the core sand pours out of the cored cavity. The boric acid helps to prevent hygroscopicity.

For ordinary cores, a weaker mix could be used. The requirements of these muffler cores demand these special properties and, consequently, a strong mix. The core baking cycle used was 2½ minutes. Cores were not given any dip or wash but were used in the molds just as they came from the core oven.

The cost of operating this dielectric oven on this muffler core will be of interest. On this job, the core load in pounds per hour through the oven is light because of the nature of the core. The oven has a capacity of handling 500 lb of core mix per hour and, if fully loaded, the power cost per hour is at a minimum. However, for this muffler core with its light load factor, the power cost was $0.00136 per pound of core mix put through the oven. In this calculation, a power cost of 1.25 cents per kilowatt-hour was used.

It appears that the advantages of this type of unit are speed, accurate control, good baked strength, and the fact that cores cannot be overbaked.

The speed with which a core can be obtained should be explained more fully as it can be very important, especially in a production shop. Occasionally, a pattern has to be changed quickly and unless cores for it are available, the problem of running it may become one of waiting for cores to be available. Since a dielectric oven will completely process cores in 5 minutes (2½ minutes for baking cycle and 2½ minutes for cooling cycle), it is possible to have cores ready by the time a new pattern is put into production. This gives a flow of so-

called emergency cores very quickly.

One serious problem is that, in most cases, vertical core rods or wires cannot be used in a dielectric unit. The metal when standing vertically disturbs the electrical field and prevents core baking. On these muffler cores, we used small wood sticks. As a matter of fact, wood "applicator" sticks obtained from a medical supply house were used; but for other cores we have used everything from toothpicks to larger sticks successfully. Horizontal metal rods or wires can be used freely and do not affect the functioning of the dielectric oven.

A serious obstacle to more general use of this type of equipment is the core drier situation. Metal driers, either cast iron or aluminum, cannot be used. A drier must be fabricated from a material which is, essentially, an insulator. Considerable work has been done on this, and it now appears that there are some materials readily available which will meet all the requirements of a drier. This is being investigated, and it appears that there will be a solution to this problem in the very near future. Naturally, unless driers can be developed, the equipment has severe limitations.

Cores Dry Quickly

However, if a drier can be made, a rather interesting thing takes place. Since cores are baked in a dielectric oven in approximately a 2½ minute cycle, it immediately becomes evident that a very small quantity of core driers will maintain production rates. This can appreciably reduce the initial cost of equipment.

It must be distinctly understood that this type of core oven is not a panacea or a cure-all for any foundry—it is not meant to be. It will probably never generally replace standard core ovens. However, it appears to be a very valuable supplementary piece of coremaking equipment which has real value for handling certain types of production cores. It does not have the flexibility to handle extreme ranges in size of cores, but it will give excellent results when properly set up for making production cores. It will handle some of the "tough" core jobs extremely well.

Issues Management Bulletins

American Management Association, 330 West 42nd St., New York 18, has available a bulletin entitled "Cutting Tomorrow's Costs," for production executives. Included in the booklet are articles on Product Reseach, Product Design, Process Research, and Planning and Co-ordination. Copies may be secured at $1, from the association.

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DUST CONTROL: Claude B. Schneible Co., 2827 25th St., Detroit 16.—Bulletin 47 presents a modern concept in foundry dust control and ventilation. It describes how clean air throughout the foundry may be obtained at low cost. Numerous installations of dust control equipment in various departments of foundries are discussed in detail.

HAND CRANES: Downs Crane & Hoist Co., 540 West Vernon Ave., Los Angeles 37—27-page bulletin 1000-A illustrates a wide variety of hand cranes, describes safety factors, construction features, capacity ratings, unit parts and replacement parts.

CRUCIBLE FURNACES: Eclipse Fuel Engineering Co., 725 South Main St., Rockford, Ill.—Bulletin on crucible gas-fired furnaces covers complete line of company's crucible furnace units. One page is devoted to technical data of interest to foundrymen and others working on the melting of metals.

AFTERCOOLERS: Worthington Pump & Machinery Corp., 401 Worthington Ave., Harrison, N. J.—Bulletin L-802-B2 describes aftercoolers for removing moisture from air or gas. Tables of dimensions for the different types of aftercoolers are included. Bulletin H-620-B26 gives capacities, ratings, specifications and dimensions of the company's air compressors.

VIBRATION CONTROL: Korfund Co. Inc., 48-14 32nd Pl., Long Island City 1, N. Y.—Catalog LK 550 gives complete description and engineering data on simple steel spring vibration isolating units available in 26 sizes for rated loads of 75-12,000 lb. Properly installed and adjusted these units provide efficient vibration control for many types of industrial equipment.

CASTERS: Rapids-Standard Co. Inc., Dept. C-127, 308 Peoples National Bank Bldg., Grand Rapids 2, Mich.—44-page industrial caster manual containing general information, technical data and illustrations gives prospective caster purchaser information on how to select the correct caster for any use. Manual also contains descriptions of other material handling equipment.

BREATHING APPARATUS: Mine Safety Appliances Co., Braddock, Thomas and Meade Sts., Pittsburgh 8—Bulletin describes self-contained oxygen breathing apparatus in which the wearer is independent of the outside air. It affords complete respiratory protection for 45 minutes or more and generates its own oxygen for the wearer with a replaceable canister.

CAUSTIC SODA: Pittsburgh Plate Glass Co., Columbia Chemical Division, Fifth Ave. at Bellefield, Pittsburgh 13—Form A-100 is a 72-page text designed for use by technical men, buyers and executives interested in the economics of caustic soda; the operations man who is interested in procedures for unloading, handling and storing the chemical; the engineer who must design equipment and the student or layman who desires useful data on the characteristics, uses, forms, transportation, constants, etc., of casutic soda.

REFRACTORIES: Norton Co., 1 New Bond St., Worcester 6, Mass.—Booklet describes the company's line of heavy duty refractories and brick laying cements. Included are tables of refractory properties and characteristics, standard brick shapes and other pertinent data.

PROTECTIVE OIL: Oakite Products Inc., 157 Thames St., New York 6—Booklet on protective oil provides data on temporary or semipermanent rust protection of ferrous parts or work following such operations as grinding, machining, pickling, tumbling, sand blasting, brazing, etc.

CORROSION RESISTANT PAINT: Prufcoat Laboratories, 63 Main St., Cambridge, Mass.—Folder lists features of the protective paint, chemical agents which the coating resists, a number of actual case histories of its use, as well as uses and complete application information about the paint.

BLOWERS: Bruer Electric Mfg. Co., 5124 North Ravenswood Ave., Chicago 40—Leaflet describes company's electric blowers and industrial vacuum cleaners. Blower weighs only 14 lb and delivers air at a speed of 295 mph. Cleaner develops a suction of 49 in. waterlift and 180 cfm.

AIR CONDITIONING: Allis-Chalmers Mfg. Co., 1126 South 70th St., Milwaukee 1—Heating, ventilating and air conditioning equipment is presented in bulletin 25B6183. Equipment portrayed and described includes V-belt drives, centrifugal pumps, ac and dc motors, a complete line of motor control, dry-type transformers and ac and dc welders.

COOLING BUILDINGS: Ilg Electric Ventilating Co., 2850 North Crawford Ave., Chicago 41—Folder presents the "night-cooling" idea of drawing cool, refreshing nighttime air through open windows of factories and office buildings and expelling that air along with daytime heat, smoke, odors and bad air through windows, walls, skylights or penthouses on the roof in which electrically driven fans are installed.

BLUEPRINTING: C. F. Pease Co., 2601 West Irving Park Rd., Chicago 18—238-page general catalog contains information on the company's line of blueprinting machines and accessories, whiteprinting (dry direct process) machines and accessories, sensitized papers and cloths, drafting room furniture and photographic arc lamps. Equipment described covers a wide range of drafting room needs. Pages are devoted to descriptions of applications and detailed information regarding measurements and weights of equipment.

MANAGEMENT TECHNIQUE: Consolidated Management Consultants, 521 Fifth Ave., New York 17—Report de-

scribes new industrial engineering management technique which applies statistical principles to production management problems. The system is designed to provide, without time studies, a simple yet reliable means of measuring the time and production lost due to low productivity, idleness, breakdowns, bad material, faulty planning or other causes. No questionnaires, interviews or time studies are used. Booklet includes case studies of organizations using the system.

BLAST CLEANING: American Wheelabrator & Equipment Corp., 555 South Byrkit St., Mishawaka, Ind.—Catalog 214-A describes the company's swing table airless abrasive blast cleaning machine capable of handling work of a wide variety of shapes, sizes and weights. Detailed information on each of the five sizes available includes construction features, overall dimension drawings and specifications. In addition, sections are devoted to operating performance facts, ventilation requirements, installation photographs, and design variations available for handling special cleaning applications.

REPRINTS: Air Reduction, 60 East 42nd St., New York 17—Reprints of articles published in *Steel* are offered. One is entitled "Removal of Dissolved Gases from Molten Metals by Flushing" and covers in detail the most efficient and economical method of removing harmful gases from molten metals. The other "Use of Oxygen in the Open Hearth," covers the possibility of increasing production by firing oxygen with the regular fuel during the meltdown. Both articles are illustrated with photographs and diagrams.

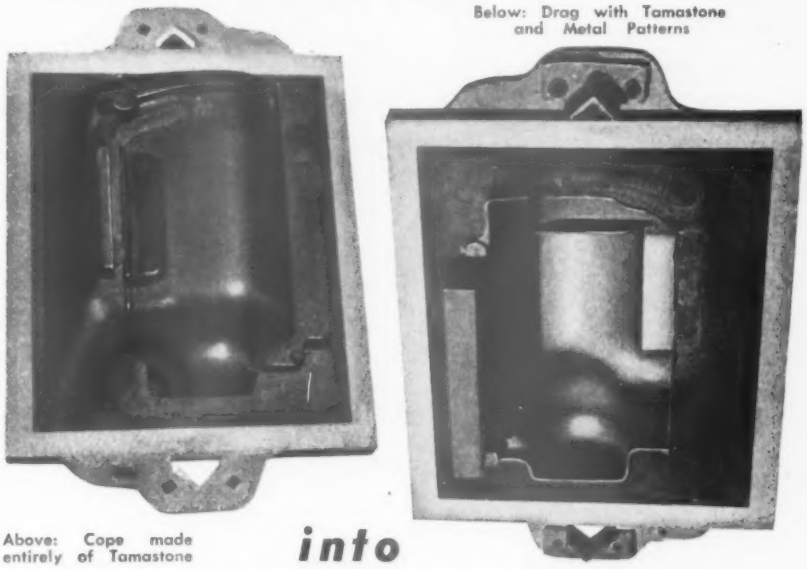
X-RAY DIFFRACTION: North American Philips Co. Inc., 100 East 42nd St., New York 17—Folder R1063 describes the principles of x-ray diffraction and how it is performing difficult jobs in modern industrial applications. Typical x-ray diffraction film is shown and explained. Geiger-counter x-ray spectrometer is discussed in connection with qualitative and quantitative analysis work.

MAGNETIC CLUTCHES: Stearns Magnetic Mfg. Co., 662 South 28th St., Milwaukee 4—Catalog 226 on magnetic clutches and clutch-brake units is a compete textbook on magnetic clutch application and contains specifications, illustrations, torque formulas and other valuable information on magnetic friction device control.

CAR DUMPERS: Link-Belt Co., 300 West Pershing Rd., Chicago 9—Booklet 2048-A is devoted to rotary dumpers for mine cars and railroad cars. Standard railroad car dumper will handle cars measuring 26 to 60 ft long, 6 ft, 8 in. to 12½ ft high, 9 to 11 ft wide, of capacities up to 120 tons. Illustrations of typical installations are provided.

SANDCUTTERS: American Wheelabrator & Equipment Corp., 505 South Byrkit St., Mishawaka, Ind. — Folder describes the company's line of sandcutters and explains the advantages of their use in terms of better castings, reduced drudgery and time saved.

LOOSE PATTERN JOBS CONVERTED



Below: Drag with Tamastone and Metal Patterns

Above: Cope made entirely of Tamastone

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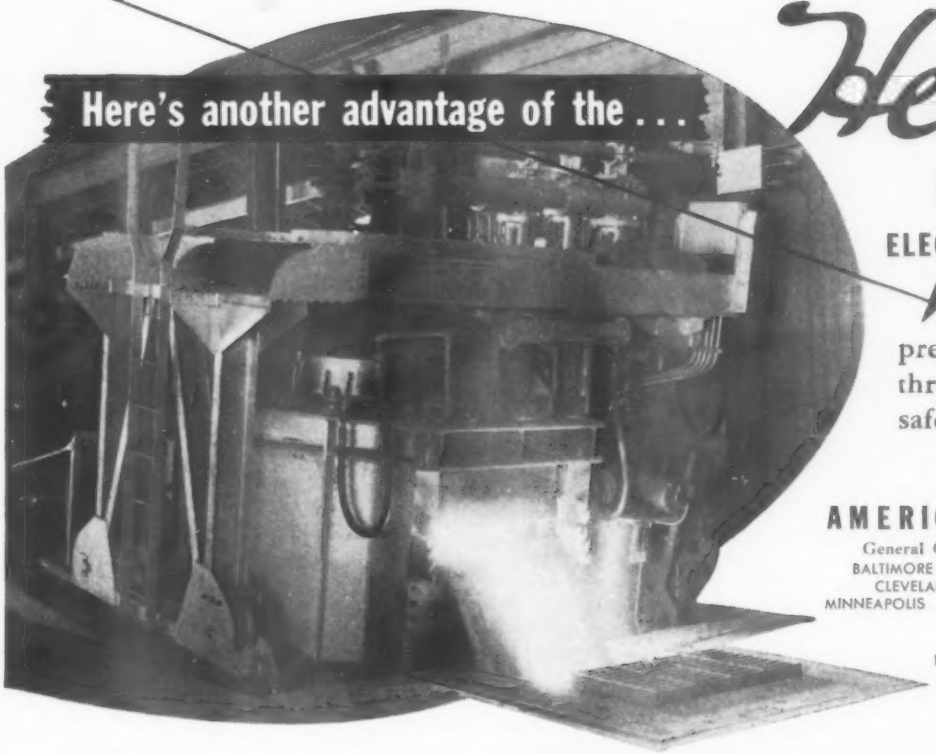

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United steel jackets are designed and manufactured exclusively for foundrymen who demand a superior product for high production work . . . Unique channel construction assures extra strength and durability . . . New self-cooling double reinforcement at the parting line eliminates warping on runouts . . . All parts are electrically spot welded with additional arc welds at strategic points.

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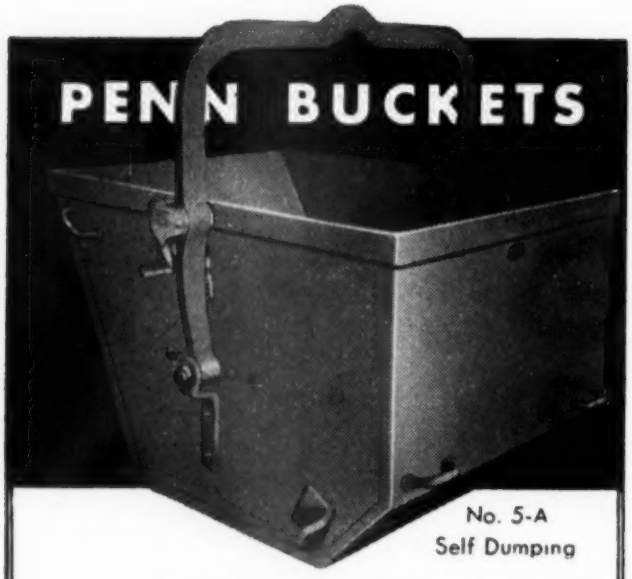

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PERMIT US TO HELP

Because we were pioneers in the cooling, cleansing and drying of air under high pressure; and because our standard line of aftercoolers, separators and traps have been so universally successful in the jobs for which they are recommended; we are often asked to solve out-size problems requiring especially engineered equipment

We welcome this work, and produce our special designs under the same money-back guarantee of satisfactory performance which applies to our standard line. Where a standard unit will do the work required, however, that is recommended.

Consult with us . . . perhaps our specialized experience can save you money. Our recommendations are made without charge, and our products, standard or special, are installed **under money-back guarantees.**

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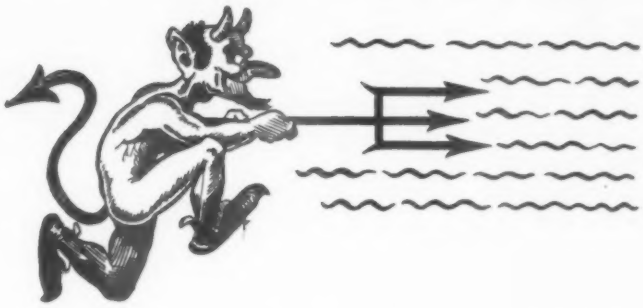
Moisture Elimination Up To 3000 Pounds Per Square Inch

SOFFEL'S FLUXES



For Ferrous and Non-Ferrous Metals

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Modern metallurgical research has definitely proved that the use of fluxes in the production of high-quality castings is no longer a luxury, but has become an economic necessity. In the highly competitive market of today, progressive foundries who are enjoying the greatest volume of sales are those who regularly use SOFFEL'S FLUXES in the production of their castings.

Many manufacturers have offered to the trade fluxes advertised as "cure-alls" for all metallurgical evils. Many years of experience have taught us that no one single flux can be efficient and practical for all types of metals and alloys. Most of these "cure-all" fluxes function only as a slag cover to protect the surface of the metal, and contribute little or nothing to the removal of occluded gases, oxides, and other impurities from the metal.

Through constant study and research into the problems of metal refining, we have scientifically compounded a FLUX for every alloy and melting method. SOFFEL'S FLUXES are designed not only to prevent oxidation of the metal during melting, but also to cleanse and purify the metal through their chemical reactions. Metal which has been refined by the use of SOFFEL'S FLUXES will have more fluidity, less shrinkage, and will produce castings of better color and higher tensile strength. Occluded gases and oxides are removed. Linings of furnaces, ladles, and crucibles will stay clean and last longer. We also manufacture Fluxes for removal of aluminum and iron contamination from brass, bronze, and copper, and for removal of magnesium contamination from aluminum.

For refining aluminum and its alloys, SOFFELITE ALUMINUM FLUXES are unexcelled. They will produce a high degree of fluidity and remove aluminum oxide and iron from the metal. Sound, clean castings can be produced with the use of SOFFELITE which are free from shrink cracks, gas holes, and misruns. Questionable scrap can be refined and cast into quality castings of higher tensile strength. Metal loss in dross skimmings is prevented.

Try our Soffel's Mold Coatings for permanent mold and die casting. Also Klen-Zinc Flux for zinc and white metals to remove iron and sulphur.

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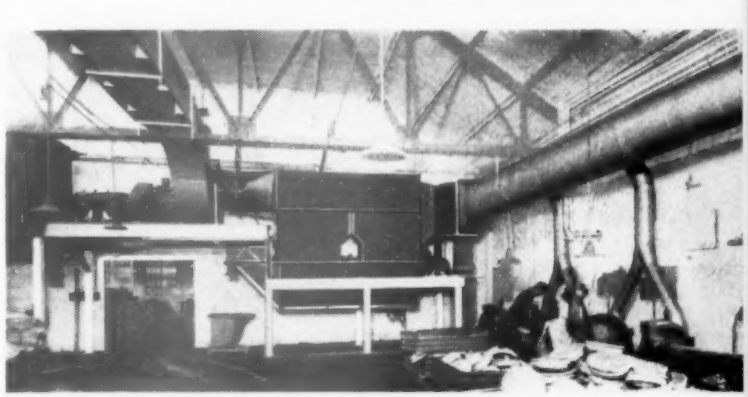
Automatic DUST and FUME Eliminator

Dust and fumes don't get a chance to circulate in plants equipped with a Schmieg CENTRI-MERGE Eliminator. The moment dust or fumes develop, they are swept up on an air stream that carries them back through ducts to a central Collection Unit. In the washing chamber of this Unit the CENTRI-MERGE high pressure centrifugal water action literally *scrubs* every last vestige of contamination from the air stream—cleans it so thoroughly that, in many cases, it can be recirculated back into the plant. That's why users are so enthusiastic about what CENTRI-MERGE accomplishes. Protects both workmen and work.

Consult Schmieg engineers regarding your problems of dust and fume control.



CENTRI-MERGE Collection Units are available in capacities to handle any air cleaning job—small or large. May be installed singly or in batteries, depending upon volume of air to be handled.

THE best AIR PURGE is CENTRI-MERGE

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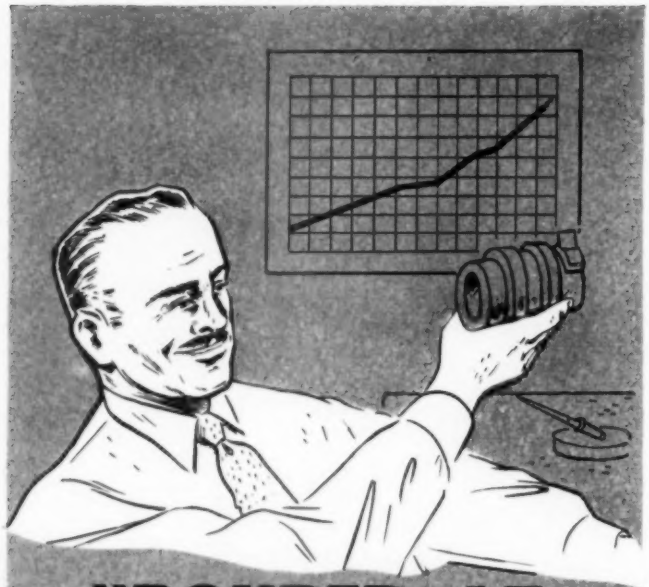

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New alloys and more intricate designs in castings now call for still closer control of pouring temperatures. In this field, too, the use of Marshall Enclosed-Tip Thermocouples is improving casting results.

Checking molten metal temperatures in furnace or ladle is made easy with a Marshall Thermocouple. These instruments eliminate the danger of over-heating or under-heating and consequent loss of the casting, core, and labor involved.

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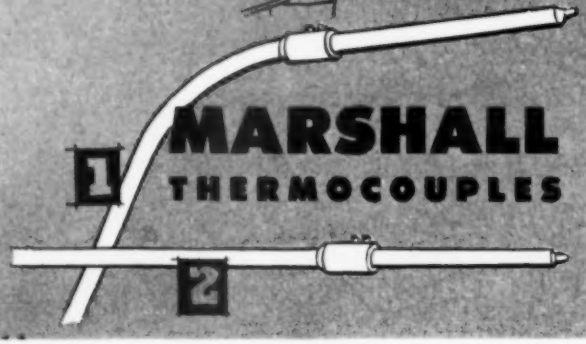
Marshall Thermocouple shown below, (No. 1), is for furnace use, has 8-inch tip, and overall length of 50 inches.

Shown as No. 2, below, is the Marshall Thermocouple for ladle use. Has 5-inch tip, is 35 inches long overall.



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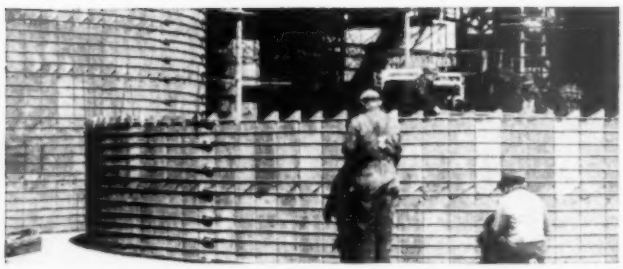

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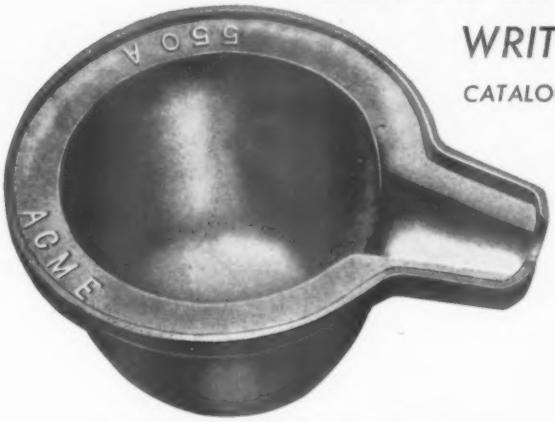

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WITH 1½" COLLAR ON FLANGE

WRITE for
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HOLDING——→
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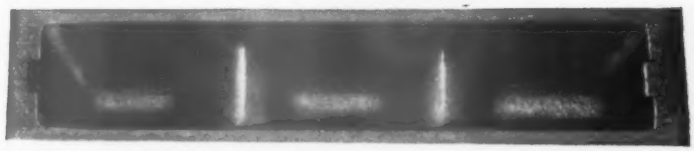

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SIMPLIFIED
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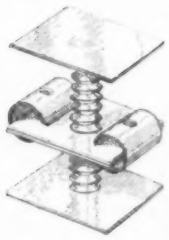
HIGH SILICON IRON JISCO

THE JACKSON IRON & STEEL *Company*
JACKSON, OHIO

CHAPLETS

CHAPLET

CLIPS



Easy to use, these handy clips provide a quick means of fastening two or more chaplets together. Are made of special steel which fuses readily . . . has sufficient spring yet retains necessary firmness.

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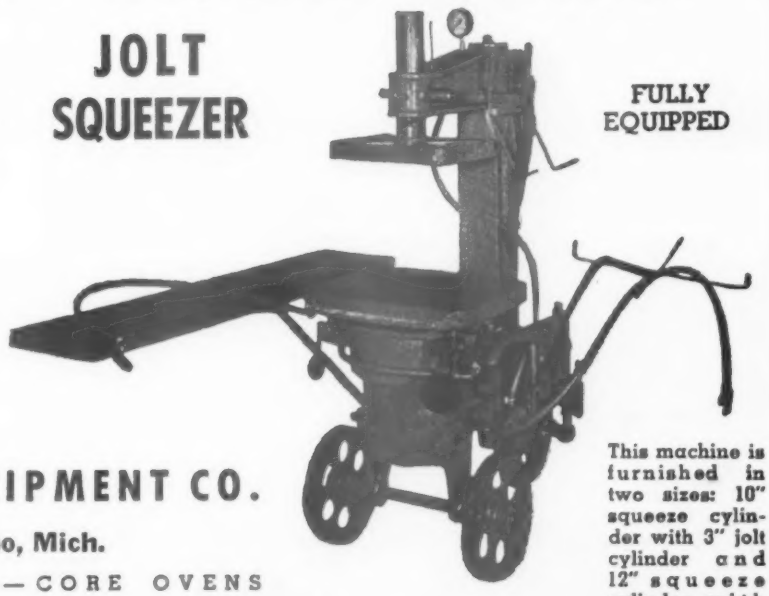
HAYNES EQUIPMENT

JOLT SQUEEZER

FULLY EQUIPPED

● The post and squeeze cylinder on the HAYNES JOLT SQUEEZER is cast all in one piece. There are no bolts or screws in this machine. The top of the post is machined on top with a 2 7/16" cold rolled shaft which the swing arm swings on.

This is a portable machine with three wheels, two in front, one in back, zerk fittings on all moving parts. Comes equipped with air gauge, pop-off gauge and a pin on top of the arm for a gate horn.



This machine is furnished in two sizes: 10" squeeze cylinder with 3" jolt cylinder and 12" squeeze cylinder with 4" jolt cylinder.

HAYNES FOUNDRY EQUIPMENT CO.

814 Ada Street—Kalamazoo, Mich.

LADLES — BRASS FURNACES — CORE OVENS

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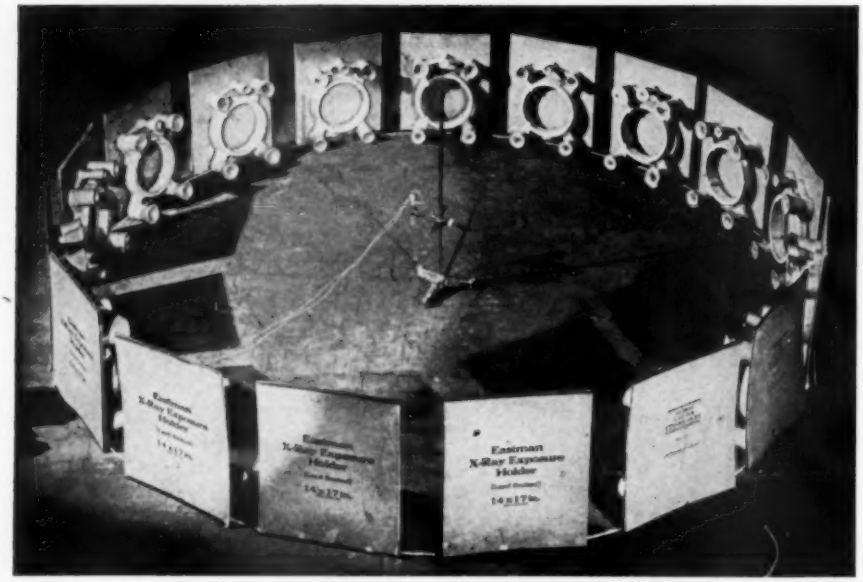

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"Directional solidification" can easily be studied by the set-up illustrated in the photograph—to indicate the best method of casting with a minimum of defects in the casting itself.

Radium has become a new foundry tool which directly effects an increase in yield. It permits accurate determination of the proper procedure in gating and risering "tough" castings. Seventeen cylindrical castings were radiographed simultaneously by Crane Co. to ascertain the most productive and economical foundry practice.

Radium thus performs a valuable additional function.

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PIPE SIZE	1/16"	1/8"	1/4"	3/8"	1/2"
PRICE F. O. B. HAMILTON, O.	$12.00	$12.00	$12.00	$14.50	$18.00

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An electronic instrument combining advanced electrical science with sound procedure and practical for plant use in most molding and core sands. Quick manual readings, ¼% accurate and either relative or % of moisture when set for one type sand.

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LOCALIZED POROSITY
CRACKS
CORE SLIPS
PATTERN-ERRORS

If your castings are in sound condition generally, you can quickly and permanently cure them of many minor troubles . . . with NI-ROD* Electrodes for machinable welds in cast iron.

Ni-Rod's deposits are easy to make and easy to machine. Here's how they can help you to save time . . . and lots of extra labor when you meet the following common defects:

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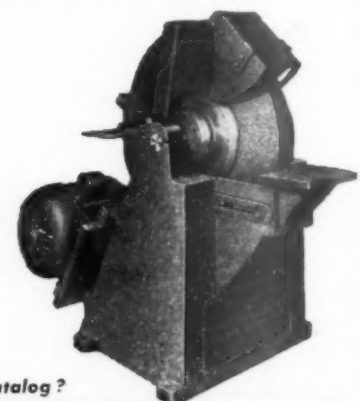

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GLOBE IRON CO JACKSON, O.

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Here at last is peak efficiency in Shot and Grit for blast CLEANING and PEENING. AMASTEEL SHOT and GRIT are far better than ordinary hard iron abrasives because they are TRUE ALLOY STEEL.

Compared to regular blasting materials, AMASTEEL offers an amazing superiority due to its long life and resistance to breakdown and greater CLEANING and PEENING speed. This feature means additional savings on labor, handling, storage, freight costs, and dust disposal.

AMASTEEL is produced under exclusive patents and is available in sizes that meet all CLEANING and PEENING requirements.

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MORE PRODUCTION—with Uniformity . . . Speed
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Castflux very substantially increases the temperature of the metal due to its exothermic reaction.

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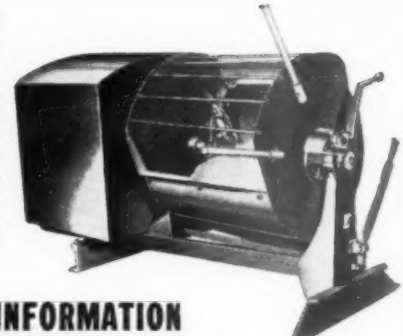

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HELPFUL LITERATURE

NOTE TO READERS: If you will check the item or items described which particularly interest you, we will be glad to request the manufacturers concerned to send you their literature. Use the attached postal card.

1. Hand Trucks

Sage Equipment Co.—Illustrated leaflet "Sage Hand Trucks" lists features and dimensions of hand trucks which are equipped with large diameter, ball bearing rubber-tired wheels for easy rolling.

2. Steel Flasks and Slip Jackets

Industrial Fabricating Inc.—4-page illustrated folder No. 147 shows examples and discusses facilities for production of steel flasks and slip jackets to fit individual specifications.

3. Metal Cleaning Process

Kolene Corp.—8-page illustrated catalog "The Kolene Process" describes method and equipment for removing core sand, foundry scale, rust, silica and carbon inclusion from gray iron castings as well as for other metal cleaning and surface preparation applications.

4. Shakeout Booth

Newcomb-Detroit Co.—8-page illustrated catalog "The Uni-Wash Shake-out Booth" describes construction and operation of dust arrestor which is delivered preassembled. Unit requires connection of water, electrical services and discharge duct only. Automatic damper for use with booth is covered also.

5. Overhead Cranes

Chicago Tramrail Co.—8-page illustrated folder "On the Right Track" presents typical installation photos and information on underhung flexible push type, single girder transfer, single girder motor driven and double girder motor driven cranes as well as top running single and double girder type push and motor driven units in capacities ranging from ½ to 10 tons.

6. Grinders & Buffers

Brown-Brockmeyer Co.—6-page illustrated bulletin No. 7000 presents specifications, applications and performance data on B-Line standard and deluxe models of bench and heavy duty grinding and buffing machines. Attachments and dressers are covered.

7. Contact Pyrometer

Illinois Testing Laboratories, Inc.—12-page illustrated bulletin No. 4257 presents data on Alnor Pyrocon contact pyrometer for measuring surface temperatures. Applications, typical installations, specifications, prices and scales available are covered.

8. Dust Control and Ventilation

Claude B. Schneible Co.—32-page illustrated bulletin No. 47 "Schneible in the Foundry Industry" shows how effective dust control and ventilation are applied to various foundry departments. Installations depicted are for mold conveyor unit including sand handling, preparation of shakeout, cupola, melting department, core room, cleaning room and grinding operations. Complete equipment for various functions is described.

9. Refractory Castable

Babcock & Wilcox Co.—Folder No. R-21 contains instructions for use of Kaocast refractory castable that withstands temperatures as high as 3000 F. It can be used either as ramming mixture or poured into place in same manner as concrete.

10. Rotary Cutting Tools

Severance Tool Industries Inc.—28-page illustrated catalog No. 16 contains information on line of Midget Mill deburring, tube cutter and countersink tools as well as miscellaneous types. Tables of recommended cutting speeds and other data are included.

11. Portable Air Compressor

Davey Compressor Co.—4-page illustrated bulletin form No. E-216 includes detailed mechanical specifications of Air Chief portable air compressors with capacities of 60, 105, 160, 210 and 315 cubic feet per minute.

12. Lifting Magnets

Ohio Electric Mfg. Co.—8-page illustrated bulletin No. 112 on electric lifting magnets gives detailed information on construction features of magnets and magnet controllers, as well as sizes, capacities and applications for all models.

13. Band Saws

Wells Mfg. Co.—6-page illustrated folder "Wells Metal Cut-Off Saws" and insert deal with models No. 5 horizontal utility saw; No. 12 horizontal saw having capacity of 12 by 16-inch rectangular; No. 9 vertical for cutting metal, wood and other materials; and No. 8 horizontal which can be adapted to wet cutting operations.

14. Rehandling Bucket

Hayward Co.—8-page illustrated bulletin No. 697 describes E-16 rehandling clamshell bucket for handling sand, gravel, crushed stone, cement clinker and other bulk materials. Chart lists load capacities, weights and dimensions in terms of various materials handled, together with figures on recommended wire rope diameters, reeving and closing lengths.

15. Oil & Gas Burners

Hauck Mfg. Co. — 12-page illustrated catalog No. 1043 contains information on oil and gas burning equipment for use in lighting cupolas, heating and drying ladles, drying molds, heating forehearth, drying spout linings, patching cores, preheating for welding, heat treating furnaces and other plant operations.

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16. Safety Shoes

Titan Safety Shoe Co.—8-page illustrated folder deals with line of industrial safety shoes designed especially for use in foundries. Shoe models No. 804 and No. 807 can be supplied in wide range of sizes having either plain or safety toes.

17. Hand Cranes

Downs Crane & Hoist Co.—28-page illustrated bulletin No. 1000A describes complete line of hand operated overhead and other industrial cranes. Plan by which purchaser can buy complete units ready for use, parts for fabrication in his own shop, or detailed shop drawings for complete fabrication is explained. Complete specifications and operating data are given.

18. Industrial Cleaning

Breuer Electric Mfg. Co.—4-page illustrated folder No. 3 describes Tornado line of industrial vacuum cleaners, portable electric blowers, noiseless vacuum cleaners, electric markers and electric etchers.

19. Electric Chain Hoists

Whiting Corp.—8-page illustrated bulletin No. H-100-A covers line of electric chain hoists; analyzes need for hoists; describes operation and gives complete specifications, speeds, prices and other data on ¼, ½ and 1-ton units.

20. Dust Collectors

American Blower Corp.—72-page illustrated bulletin No. 1128 presents operating principles, design features, fields of application, efficiency factors and typical laboratory reports on type D collectors and types R and S dust valves.

21. Blast Cleaning Machine

American Wheelabrator & Equipment Corp.—Illustrated catalog No. 214-A describes Wheelabrator Swing Table which is airless abrasive blast cleaning unit with work tables of 24, 48, 66, 72 and 85-inch diameters. Specifications, performance data, ventilation requirements, installation photographs and design variations are included.

22. Mobile Crane

Unit Crane & Shovel Corp. — 12-page illustrated catalog No. 46-B presents information on model No. 357 self-propelled mobile crane which is converted easily to shovel, trenchoe, back-filler, clamshell, dragline, pile driver or magnet.

23. Openspace Heating

Dravo Corp.—12-page illustrated bulletin No. 516 describes Dravo Counterflo heater designed for industrial and commercial use. Elimination of refractory lining within combustion chamber and fuel convertibility from oil to gas are features.

24. Materials Handling

Lamson Corp. — 4-page illustrated folder No. 746 reveals information on line of gravity and Live Roll conveyors; slat conveyors; booster, belt and overhead type conveyors; and pneumatic dispatch tubes. Application photos are included.

25. Carbide Tipped Drill

Ray-Metal Co.—4-page illustrated folder describes Hi-Rockwell drill for drilling holes in tool steel with Rockwell hardness to 70C. Specifications and prices are given for straight shank drills.

26. Business Activity Chart

A. A. Wickland & Co.—Folding wall chart graphically illustrates national income, federal debt, business activity, stock averages, cost of living and commodity costs from 1775 to 1947. Presidential administrations and wars are indicated.

27. Mobile Swing Boom Crane

Silent Hoist Winch & Crane Co.—6-page illustrated bulletin No. 68 presents information about Rail-O-Road Krane Kar mobile swing boom crane that operates both on and off railway tracks. Three models are available with capacities to 20,000 pounds.

28. Industrial Trucks & Tractors

Clark Equipment Co., Tructractor Div. —36-page illustrated general catalog describes complete line of gasoline engine and battery powered electric industrial trucks and tractors. Specifications, recommended uses, features and operating data are given on all models.

29. Dust Control

American Air Filter Co. — 20-page illustrated bulletin No. 272-A describes type D Roto-Clone dynamic precipitator for dust control. Principle of operation, design and recommended applications are discussed. Dimensional data, capacity tables and pipe resistance chart are given.

30. Hand Grinder

William H. Howland — 2-page illustrated bulletin presents details of Gaston grinder that employs no gears, brushes or commutators and starts at full speed. Available in three sizes of 1, 1½ and 2-horsepower, units are furnished in either cup wheel or edge wheel type.

31. Crucible Furnaces

Eclipse Fuel Engineering Co.—Illustrated bulletin covers complete line of crucible gas-fired furnaces. One page is devoted to technical data of interest to foundrymen and others interested in melting of metals.

32. Industrial Safety Equipment

Pulmosan Safety Equipment Corp.—78-page illustrated loose-leaf catalog and insert data and price list cover complete line of industrial safety equipment. Dust, gas and heat protective equipment and safety goggles and clothing are featured.

33. Flight Conveyors

Hapman Conveyors Inc.—6-page illustrated folder entitled "Typical Installations in Industry" cites examples of Hapman rubber flight, sealed pin conveyors in handling dust, chips and other materials. Cross sectional drawings and plant layouts are shown.

34. Electric Fork Lift Truck

Automatic Transportation Co.—6-page illustrated bulletin No. 1006 presents data on Skylift 2000, 3000 and 4000-pound capacity electric fork lift trucks with maximum lift of 130 inches. Units drive and operate in same manner as conventional automobile.

35. Refractory Material

Ironton Fire Brick Co. — 4-page illustrated bulletin describes Ironton Berlite special purpose refractory material for cupolas, foundry ladles, metal mixers, transfer cars and open-hearth runners. Features and characteristics are covered.

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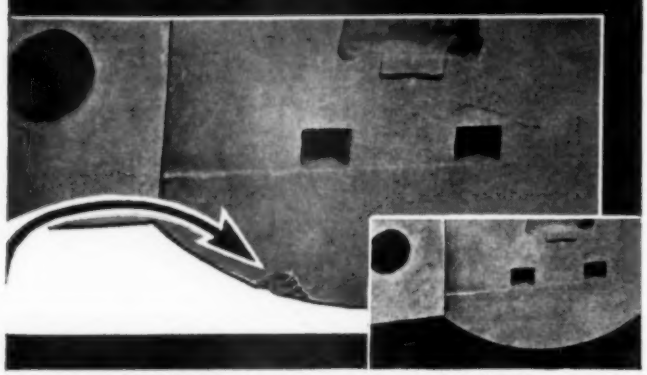

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Sand holes, blow holes, pock marks and other unimportant surface blemishes sometimes spoil the looks of castings that are otherwise perfectly sound. You cannot always prevent these blemishes. But you *can* make them practically invisible, and thereby save such castings from being rejected.

True up uneven casting surfaces with Smooth-On Foundry Cement—just as other high-grade foundries do. You apply Smooth-On like putty. No heat required. It sets hard, expands slightly as it hardens and *stays tight*.

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Match light gray castings with Smooth-On No. 4AA. Machines and polishes to a high lustre. 1-, 10- and 50-lb. sizes.

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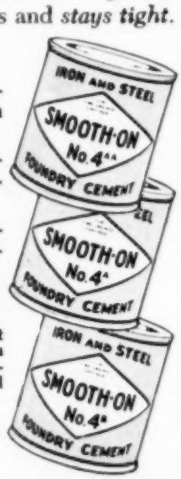

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Send the coupon and we will ship you sufficient Smooth-On Foundry Cement, of any grade you specify, to make a thorough test on your own castings. We'll also send hardened specimens of all grades.

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Shows how to use Smooth-On Iron Cements in foundry, shop and home to seal cracks, stop leaks, tighten loose parts. 40 pages of time-saving, labor-saving repairs. 170 diagrams.

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The NEW PYRO Immersion (illustrated at the right) eliminates spoilage and insures uniform and sound non-ferrous castings. Bare Metal and Protected Type thermocouples instantly interchangeable.

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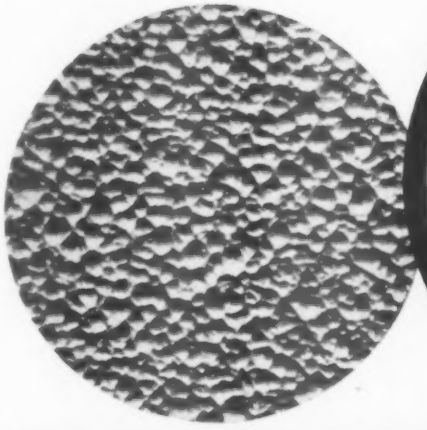

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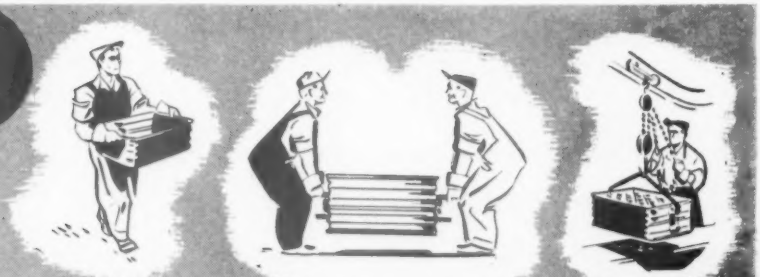
Do you have a small, medium, or large shop? Do you use one-man, two-man, or crane-type flasks? Do you need square, round or oblong shapes? Or are your requirements unusual and demand special engineering services?



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TRUSCON has the *Answer* to every Flask Problem!

Write for illustrated catalog giving Truscon Foundry Flask details that may help you increase foundry profits.

Because of long experience in steel foundry flask operations, Truscon has the knowledge and ability to meet every requirement of light, medium and heavy casting work.

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TRUSCON STEEL CO., Pressed Steel Division • 6100 Truscon Avenue, Cleveland, Ohio • Subsidiary of Republic Steel Corporation

...Get rid of hot, smoky air *Extra Fast* with Swartwout Ject-O-Valve

New powerful ventilator helps you improve your foundry working conditions

● Where you have heat, smoke or fumes in concentrated quantities, it takes POWER to expel it fast enough to keep the atmosphere cleared for greatest comfort. It pays you to heed this requirement for better worker morale—greater efficiency and safety. Ject-O-Valve supplies concentrated force, scientifically applied, for power ventilation.

Swartwout skill in building roof ventilating equipment for over forty years is reflected in Ject-O-Valve construction: sturdy, reinforced design, correctly selected propeller type fans, convenient provision for servicing, completely weathertight under all conditions. Your plant is a better place to work in when you have Ject-O-Valve ventilation over "hot spots" or fume-producing departments. Write for details. *The Swartwout Co., 18566 Euclid Ave., Cleveland 12, O.*

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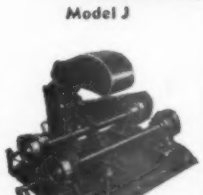
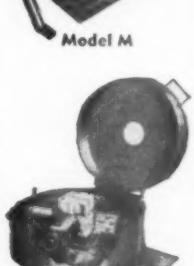
Controlled **Air Circulation**
EQUIPMENT FOR EFFECTIVE ECONOMICAL VENTILATION OF INDUSTRIAL BUILDINGS

CENTRIFUGAL CASTING MACHINES

Model AS

Model J


Model M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They are made in a large variety of styles and a wide range of sizes. Complete technical information is supplied concerning sand and permanent mold design, gating, sand mixes, speeds, etc.

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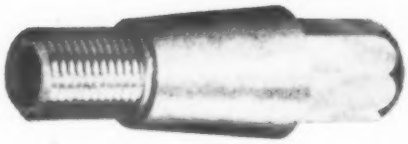

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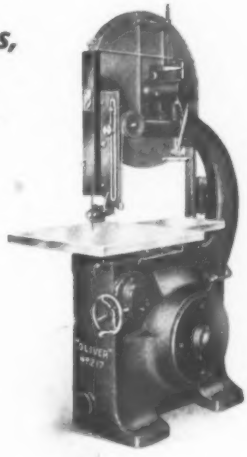

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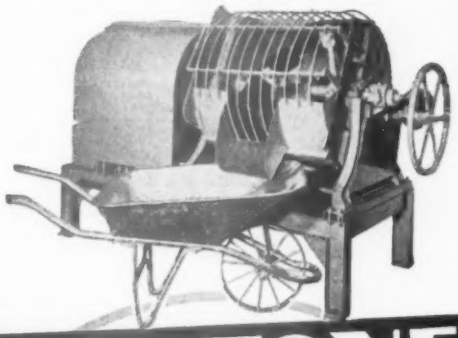

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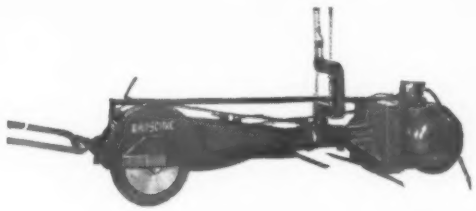

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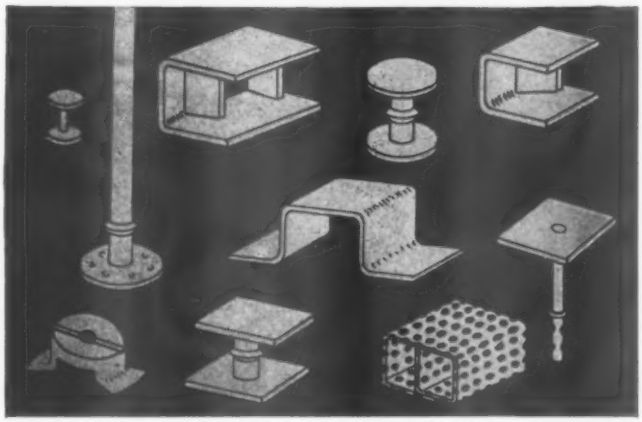

The large variety of "Buffalo" Chaplet designs enables you to meet your needs *exactly*. Given this broad selection, you are always assured of greater strength, easier burning-in and higher resistance to chilling for each specific job.

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NO. 44 HEAVY DUTY PORTABLE

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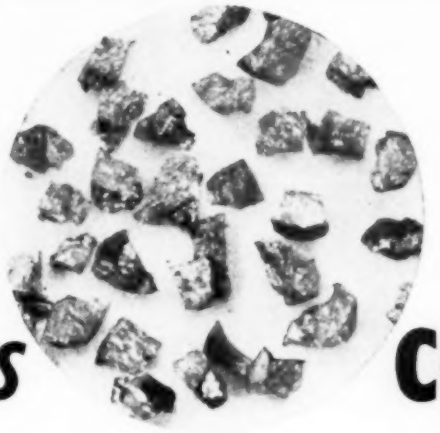

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Even the keenest cutting edge isn't effective unless it has weight behind it. This photomicrograph shows how National Controlled Grit backs its millions of sharp edges with solid, chunky, body structures. That's why National Grit hits harder, cleans faster. That's why it saves so much cleaning cost, shows greater profit per casting.

Get the facts on National Controlled Grit for your cleaning operations. Send for full details and costs today.

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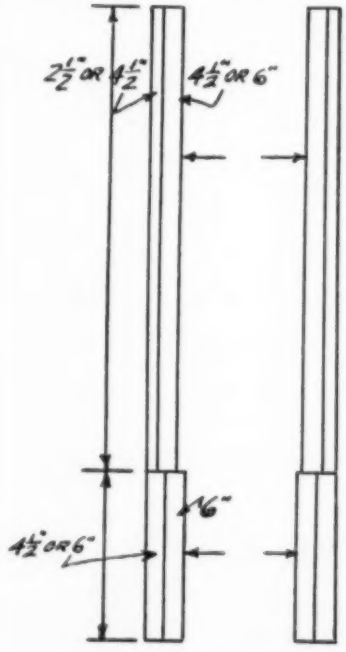
Special Shape Cupola Blocks and Series Fire Brick for all Diameters and Height Cupolas



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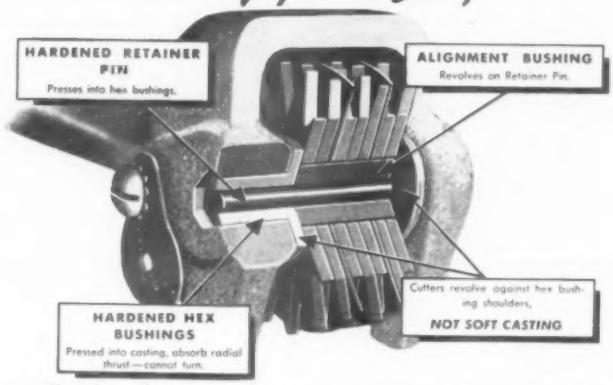
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Revolves on Retainer Pin.
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NOT SOFT CASTING
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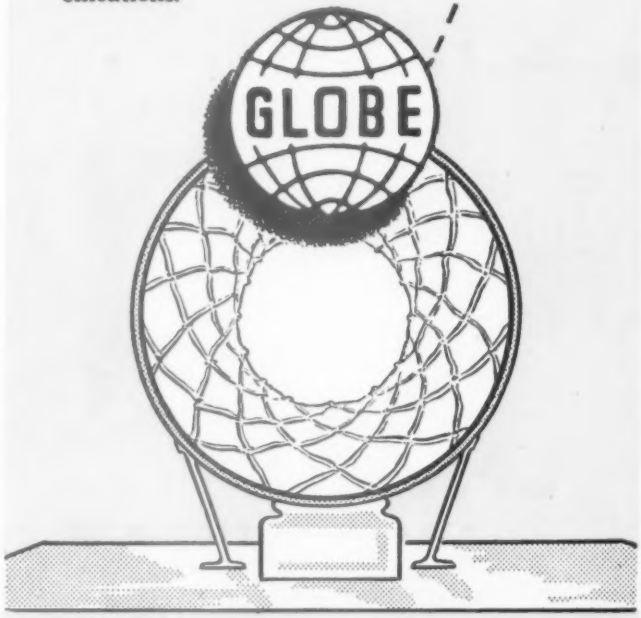

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Saves AIR

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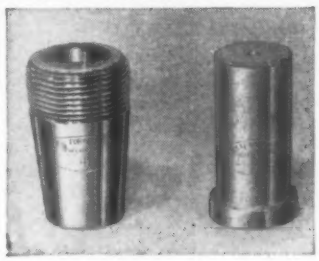

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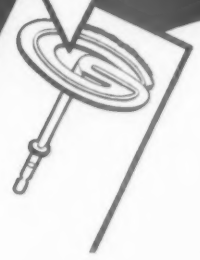

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Campbell-Hausfeld Co., Harrison, O.
Carl-Mayer Corp., 3030 Euclid Ave., Cleveland 15, Ohio.
Denver Fire Clay Co., 2301 Blake St., Denver, Colo.
Electric Furnace Co., W. Wilson St., Salem, Ohio.
Fen Machine Co., 1350 Babbitt Rd., Cleveland 17, Ohio.
Haynes Foundry Equipment Co., 814 Ada St., Kalamazoo 21, Mich.
Johnston Mfg. Co., Minneapolis 13, Minn.
Lindberg Engineering Co., 2450 West Hubbard, Chicago 12, Ill.
R-S Products Corp., 4530 Germantown Ave., Philadelphia 44, Pa.
Stroman Furnace & Engineering Co., 300 W. Adams St., Chicago 6, Ill.

FURNACES (Gray Iron Melting)

American Bridge Co., Pittsburgh 19, Pa.
Detroit Electric Furnace Div. of Kuhlman Electric Co., Bay City, Mich.
Pittsburgh Lectromelt Furnace Corp., P. O. Box 1125, Pittsburgh, Pa.
Swindell-Dressler Corp., Pittsburgh, Pa.
Whiting Corporation, 15607 Lathrop Ave., Harvey, Ill.

FURNACES (Heat Treating)

Ajax Electric Co., Inc., Philadelphia 23, Pa.
Carl-Mayer Corp., 3030 Euclid Ave., Cleveland 15, Ohio.
Despatch Oven Co., Minneapolis 14, Minn.
Eclipse Fuel Engineering Co., 711 So. Main St., Rockford, Ill.
Electric Furnace Co., W. Wilson St., Salem, Ohio.
Johnston Mfg. Co., Minneapolis 13, Minn.
Lanly Company, 750 Prospect Ave., Cleveland 15, Ohio.
Lindberg Engineering Co., 2450 West Hubbard, Chicago 12, Ill.
Maehler, Paul, Co., 2200 W. Lake St., Chicago 12, Ill.
R-S Products Corp., 4530 Germantown Ave., Philadelphia 44, Pa.

FURNACES, HEAT TREATING (Electric)

Ajax Electric Co., Inc., Philadelphia 23, Pa.
Ajax Electrothermic Corp., Trenton, N. J.
Carl-Mayer Corp., 3030 Euclid Ave., Cleveland 15, Ohio.
Despatch Oven Co., Minneapolis 14, Minn.
Electric Furnace Co., W. Wilson St., Salem, Ohio.
Lindberg Engineering Co., 2450 West Hubbard, Chicago 12, Ill.

FURNACES (Malleable Annealing)

Carl-Mayer Corp., 3030 Euclid Ave., Cleveland 15, Ohio.
Electric Furnace Co., W. Wilson St., Salem, Ohio.
General Electric Co., Schenectady, N. Y.
Lindberg Engineering Co., 2450 West Hubbard, Chicago 12, Ill.
Whiting Corporation, 15607 Lathrop Ave., Harvey, Ill.
Young Brothers Co., 6508 Mack Ave., Detroit 7, Mich.

FURNACES (Malleable Melting)

American Bridge Co., Pittsburgh 19, Pa.
Pittsburgh Lectromelt Furnace Corp., P. O. Box 1125, Pittsburgh, Pa.
Whiting Corporation, 15607 Lathrop Ave., Harvey, Ill.

FURNACES (Nonferrous Melting)

Ajax Electrothermic Corp., Trenton, N. J.
Ajax Engineering Corp., Trenton, N. J.
Ajax Metal Co., Philadelphia 23, Pa.
Campbell-Hausfeld Co., 300-320 Moore St., Harrison, O.
Detroit Electric Furnace Div. of Kuhlman Electric Co., Bay City, Mich.
Eclipse Fuel Engineering Co., 711 So. Main St., Rockford, Ill.
Fen Machine Co., 1350 Babbitt Rd., Cleveland 17, Ohio.
Fisher Furnace Co., 2453 West Hubbard St., Chicago 12, Ill.
Haynes Foundry Equipment Co., 814 Ada St., Kalamazoo 21, Mich.
Johnston Mfg. Co., Minneapolis 13, Minn.
Stroman Furnace & Engineering Co., 300 W. Adams St., Chicago 6, Ill.
Swindell-Dressler Corp., Pittsburgh, Pa.
Whiting Corp., 15607 Lathrop Ave., Harvey, Ill.

FURNACES (Powdered Coal)

Whiting Corp., 15607 Lathrop Ave., Harvey, Ill.

FURNACES (Steel Melting)

Ajax Electrothermic Corp., Trenton, N. J.
American Bridge Co., Pittsburgh 19, Pa.
Detroit Electric Furnace Div. of Kuhlman Electric Co., Bay City, Mich.
Pittsburgh Lectromelt Furnace Corp., P. O. Box 1125, Pittsburgh, Pa.
Swindell-Dressler Corp., Pittsburgh, Pa.
Whiting Corp., 15607 Lathrop Ave., Harvey, Ill.

FURNACE BLOWERS

Allis Chalmers Mfg. Co., Milwaukee 1, Wis.
Campbell-Hausfeld Co., Harrison, O.
Eclipse Fuel Engineering Co., 711 So. Main St., Rockford, Ill.
Fisher Furnace Co., 2453 West Hubbard St., Chicago 12, Ill.
Joy Mfg. Co., La-Del Division, New Philadelphia, Ohio.
Roots-Connersville Blower Corp., Connersville, Ind.

FURNACE LININGS

Campbell-Hausfeld Co., Harrison, O.
Carborundum Co., Perth Amboy, N. J.
Electro Refractories & Alloys Corp., Vars Bldg., Buffalo 2, N. Y.
Fisher Furnace Co., 2453 West Hubbard St., Chicago 12, Ill.
Ironton Fire Brick Co., Ironton, O.
National Carbon Co. Inc., Carbon Products Div., 30 E. 42nd St., New York 17, N. Y.
Stroman Furnace & Engineering Co., 300 W. Adams St., Chicago 6, Ill.
United States Graphite Co., Saginaw, Mich.

GAGES

Master Pattern Co., 1315 Main Ave., Cleveland, Ohio

GAGGERS

Federal Foundry Supply Co., 4600 E. 71st., Cleveland 5, O.

GAS

American Gas Association, 420 Lexington Ave., New York 17, N. Y.

GAS (Oxygen, Acetylene, Industrial)

Air Reduction Sales Co., 60 East 42nd St., New York 17, N. Y.

GAS BURNERS

Eclipse Fuel Engineering Co., 711 So. Main St., Rockford, Ill.
Fisher Furnace Co., 2543 West Hubbard St., Chicago 12, Ill.
North American Mfg. Co., 4455 E. 71st St., Cleveland 4, O.

GLOVES (Industrial, Safety)

American Optical Co., Southbridge, Mass.

GLUE (Liqui-Plastic)

Wellman Products Co., 1444 E. 49th St., Cleveland 3, O.

GOGGLES and EYE PROTECTORS

American Optical Co., Southbridge, Mass.
Chicago Eye Shield Co., 2300 West Warren, Chicago 12, Ill.
Pulmosan Safety Equipment Co., 178 Johnson St., Brooklyn, N. Y.
Mine Safety Appliances Co., Braddock, Thomas and Meade Sts., Pittsburgh 8, Pa.
Wilson Products Inc., Reading, Pa.

GRAPHITE

Asbury Graphite Mills, Asbury, N. J.
Bloomsbury Graphite Co., Bloomsbury, N. J.
Federal Foundry Supply Co., 4600 E. 71st St., Cleveland 5, O.
International Graphite & Electrode Corp., St. Marys, Pa.
National Carbon Co. Inc., Carbon Products Div., 30 E. 42nd St., New York 17.
Superior Flake Graphite Co., 33 S. Clark St., Chicago 3, Ill.
United States Graphite Co., Saginaw, Mich.

GRINDERS (Electric Portable)

Chicago Pneumatic Tool Co., General Offices: 8 East 44th St., New York 17, N. Y.
Independent Pneumatic Tool Co., 600 West Jackson Blvd., Chicago 6, Ill.
Rotor Tool Co., 17325 Euclid Ave., Cleveland 12, Ohio
Standard Electrical Tool Co., 2488 Riverside Ave., Cincinnati 4, Ohio.
U. S. Electrical Tool Co., Cincinnati 4, O.

GRINDERS (Flexible Shaft)

Mall Tool Co., 7720 South Chicago Ave., Chicago 19, Ill.
N. A. Strand Co., 5001 N. Wolcott Ave., Chicago 40, Ill.

GRINDERS (Pneumatic Portable)

Chicago Pneumatic Tool Co., General Offices: 8 East 44th St., New York 17.
Cleco Pneumatic Tool Div., Reed Roller Bit Co., Houston, Texas
Independent Pneumatic Tool Co., 600 West Jackson Blvd., Chicago 6, Ill.
Rotor Tool Co., 17325 Euclid Ave., Cleveland 12, Ohio

GRINDERS (Surface, Bench, Disc, Floor)

Fox Grinders, Inc., Oliver Bldg., Pittsburgh 22, Pa.
Independent Pneumatic Tool Co., 600 West Jackson Blvd., Chicago 6, Ill.
Mall Tool Co., 7720 South Chicago Ave., Chicago 19, Ill.
Standard Electrical Tool Co., 2488 Riverside Ave., Cincinnati 4, Ohio.
N. A. Strand Co., 5001 N. Wolcott Ave., Chicago 40, Ill.
U. S. Electrical Tool Co., Cincinnati 4, O.
Vonnegut Moulder Corp., 1815 Madison Ave., Indianapolis 2, Ind.

GRINDERS (Swing Frame)

Fox Grinders, Inc., Oliver Bldg., Pittsburgh 22, Pa.
Mall Tool Co., 7720 South Chicago Ave., Chicago 19, Ill.
Sutter Products Co., Dearborn, Mich.
Vonnegut Moulder Corp., 1815 Madison Ave., Indianapolis 2, Ind.

GRINDING WHEELS—See ABRASIVE WHEELS

GRINDING WHEEL DRESSERS

Carborundum Co., Niagara Falls, N. Y.
Desmond-Stephan Mfg. Co., Urbana, O.
Vincent Steel Process Co., 2424 Bellevue St., Detroit 7, Mich.

GRINDSTONES

Bay State Abrasive Products Co., Westboro, Mass.
Sterling Grinding Wheel Div. Cleveland Quarries Co.,

GRIT (Abrasive)

Alloy Metal Abrasive Co., Ann Arbor, Mich.
American Steel Abrasives Co., Galion, O.

GRIT (Abrasive) (Cont'd.)

American Wheelabrator & Equipment Co., 505 S. Byrkit St., Mishawaka, Ind.
Carborundum Co., Niagara Falls, N. Y.
Clayton Sherman Abrasives Co., 3896 Lonyo Rd., Detroit 10, Michigan.
Cleveland Metal Abrasive Co., 887 E. 67th St., Cleveland, Ohio
Globe Steel Abrasive Co., Mansfield, O.
Hickman-Williams & Co., Union Commerce Bldg., Cleveland 14, O.
National Metal Abrasive Co., 3560 Norton Ave., Cleveland 7, O.
Pangborn Corp., Hagerstown, Md.
Pittsburgh Crushed Steel Co., Pittsburgh 1, Pa.

HAMMERS (Chipping)

Chicago Mfg. & Distributing Co., 1928 W. 46th St., Chicago 9, Ill.
Chicago Pneumatic Tool Co., General Offices: 8 East 44th St., New York 17.
Cleco Pneumatic Tool Div., Reed Roller Bit Co., Houston, Texas
Dayton Pneumatic Tool Co., Dayton 1, Ohio.
Independent Pneumatic Tool Co., 600 West Jackson Blvd., Chicago 6, Ill.
Joy Mfg. Co., Sullivan Division, Michigan City, Ind.
Schramm Inc., West Chester, Pa.

HARDNESS TESTING EQUIPMENT

Detroit Testing Machine Co., 19390 Grinnell Ave., Detroit 13, Mich.
Harry W. Dietert Co., 9330A Roselawn Ave., Detroit 4, Mich.

HEAT CONTROL AND RECORDING DEVICES

Foxboro Company, Foxboro, Mass.
Claude S. Gordon Co., 3000 So. Wallace, Chicago 9, Ill.
Illinois Testing Laboratories, 418 N. LaSalle St. Chicago 10, Ill.
Lindberg Engineering Co., 2450 West Hubbard, Chicago 12, Ill.
Marshall Co., L. H., 270 W. Lane, Columbus 1, O.

HEATERS (Gas, Oil, Electric)

American Wheelabrator & Equipment Co., 505 S. Byrkit St., Mishawaka, Ind.
Despatch Oven Co., Minneapolis 14, Minn.
Lanly Co., 750 Prospect Ave., Cleveland 15, Ohio.

HEATERS (High Frequency Electric)

Ajax Electrothermic Corp., Trenton, N. J.

HEATERS (Indirect Fired)

Despatch Oven Co., Minneapolis 14, Minn.

HEATERS (Space, Unit, Direct Fired)

Dravo Corp., Neville Island, Pittsburgh 25, Pa.

HEATERS (Space, Unit, Oven, Water)

American Wheelabrator & Equipment Co., 505 S. Byrkit St., Mishawaka, Ind.
Maehler, Paul, Co., 2200 W. Lake St., Chicago 12, Ill.

HELMETS (Blasting)

American Wheelabrator & Equipment Co., 505 S. Byrkit St., Mishawaka, Ind.
American Optical Co., Southbridge, Mass.
Mine Safety Appliance Co., Braddock, Thomas & Meade Sts., Pittsburgh 8, Pa.
Pangborn Corp., Hagerstown, Md.
Pulmosan Safety Equipment Co., 176 Johnson St., Brooklyn, N. Y.
W. W. Sly Mfg. Co., 4753 Train Ave., Cleveland 2, O.

HELMETS (Welding)

American Optical Co., Southbridge, Mass.

HOISTS (Air)
Chicago Pneumatic Tool Co., General Offices: 8 East 44th St., New York 17.
Curtis Pneumatic Machinery Co., 1922 Kienlen Ave., St. Louis 20, Mo.
Gardner-Denver Co., Gardner Drive, Quincy, Ill.
Independent Pneumatic Tool Co., 600 West Jackson Blvd., Chicago 6, Ill.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.
Joy Mfg. Co., Sullivan Division, Michigan City, Ind.

HOISTS (Chain)
Cleveland Tramrail Div. of Cleveland Crane & Engineering Co., 1155 East 283rd St., Wickliffe, O.
Reading Chain & Block Corp., 2108 Adams St., Reading, Pa.

HOISTS (Electric)
Cleveland Tramrail Div. of Cleveland Crane & Engineering Co., 1155 East 283rd St., Wickliffe, O.
Harnischfeger Corp., 4411 W. National Ave., Milwaukee 14, Wis.
Joy Mfg. Co., Sullivan Division, Michigan City, Ind.
Modern Equipment Co., Port Washington, Wis.
Reading Chain & Block Corp., 2108 Adams St., Reading, Pa.
Shepard-Niles Crane & Hoist Corp., 360 Schuyler Ave., Montour Falls, N. Y.
Whiting Corp., 15607 Lathrop Ave., Harvey, Ill.

HOISTS (Hand)
Cleveland Tramrail Div. of Cleveland Crane & Engineering Co., Wickliffe, Ohio.
Clipper Mfg. Co., 2800 Warwick St., St. Louis, Mo.

HOSE (Air, Blasting, Water, Gas)
Gardner-Denver Co., Gardner Drive, Quincy, Ill.
Independent Pneumatic Tool Co., 600 West Jackson Blvd., Chicago 6, Ill.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.
Pangborn Corp., Hagerstown, Md.
Raybestos-Manhattan, Inc., Manhattan Rubber Div., Passaic, N. J.
Schramm Inc., West Chester, Pa.

HYDRAULIC CLEANING EQUIPMENT
Hydro-Blast Corp., 2350 N. Western Ave., Chicago 47, Ill.
Pangborn Corp., Hagerstown, Md.
N. Ransohoff, Inc., 208 W. 71st St. Cincinnati 16, O.

ILLUMINATORS (X-Ray Film)
Eastman Kodak Co., Rochester, N. Y.

IMPREGNATING SYSTEMS
Empire Varnish Co., 2636 E. 76th St., Cleveland 4, O.

INDUSTRIAL ENGINEERING SERVICE
Lester B. Knight & Associates, Inc., 600 West Jackson Blvd., Chicago 3, Ill.

INGOT MOLDS
Acme Foundry Co., Detroit 16, Mich.

INGOTS (Nonferrous)
Ajax Metal Co., Philadelphia 23, Pa.
Aluminum Company of America, Pittsburgh, Pa.
Aluminum & Magnesium Inc., Sandusky, O.
American Smelting & Refining Co., 120 Broadway, New York 5.
Apex Smelting Co., Chicago, Ill.
Cleveland Electro Metals Co., W. 38th St. & NP RR. Cleveland 13, O.
Federated Metals Div., American Smelting & Ref. Co., New York 5.
General Smelting Co., Philadelphia, Pa.
International Nickel Co., Inc., 67 Wall St., New York City 5.
Jobbins, Wm. F., Inc., Aurora, Ill.
Lavin & Sons R., Inc., Chicago, Ill.
National Smelting Co., Cleveland, O.

INGOTS (Nonferrous) (Cont'd.)
Niagara Falls Smelting & Refining Corp., 2204 Elmwood Ave., Buffalo 17, New York.
Silverstein & Pinsof, Inc., 1720 N. Elston, Chicago 22, Ill.
Sonken-Galamba Corp., Kansas City, Kan.
U. S. Metals Refining Co., New York.
U. S. Reduction Co., E. Chicago, Ind.

INJECTION MOLDING MACHINES
Lester-Phoenix Inc., 2711 Church St. Cleveland 13, Ohio.

INOCULANTS
Carborundum Co., Perth Amboy, N. J.

IRON CEMENT
Smooth-On Mfg. Co., 570 Communipaw Ave., Jersey City 4, N. J.

IRON ORE
Bethlehem Steel Co., Bethlehem, Pa.
Pickands, Mather & Co., Cleveland 14, O.

IRON OXIDES
Chicago Mfg. & Distributing Co., 1928 W. 46th St., Chicago 9, Ill.
Delta Oil Products Co., Milwaukee 9, Wis.

JACKETS (Mold)
Adams Co., Dubuque, Iowa.
Chicago Mfg. & Distributing Co., 1928 W. 46th St., Chicago 9, Ill.
Diamond Clamp & Flask Co., Richmond, Ind.
Freeman Supply Co., 1152 Broadway, Toledo 5, O.
Fremont Flask Co., Fremont, O.
Hines Flask Co., 1324 Hird Ave., Cleveland 7, O.
Industrial Fabricating, Inc., 817 Hall St., Eaton Rapids, Mich.
United Pattern Works, 2309 Russell St., Detroit 7, Mich.

LABORATORY EQUIPMENT (Chemical)
Buehler, Ltd., 228 N. LaSalle St., Chicago 1, Ill.
Harry W. Dietert Co., 9330A Roselawn Ave., Detroit 4, Mich.
Precision Scientific Co., 3737 Courtland St., Chicago 47, Ill.

LABORATORY EQUIPMENT (Physical)
Buehler, Ltd., 228 N. LaSalle St., Chicago 1, Ill.
Harry W. Dietert Co., 9330A Roselawn Ave., Detroit 4, Mich.
National Engineering Co., 549 W. Washington St., Chicago 6, Ill.
Norton Co., Worcester 6, Mass.
Precision Scientific Co., 3737 Courtland St., Chicago 47, Ill.

LADLES
Bethlehem Steel Co., Bethlehem, Pa.
Haynes Foundry Equipment Co., 814 Ada St., Kalamazoo 21, Mich.
Industrial Equipment Co., Minster, O.
Modern Equipment Co., Port Washington, Wis.
Frederic B. Stevens, Inc., Detroit 26, Mich.
Whiting Corp., 15607 Lathrop Ave., Harvey, Ill.

LADLE HEATERS
Whiting Corp., 15607 Lathrop Ave., Harvey, Ill.

LADLE LININGS
Ironton Fire Brick Co., Ironton, Ohio.

LATHE CENTERS
Chicago Mfg. & Distributing Co., 1928 W. 46th St., Chicago 9, Ill.

LEAD
American Smelting & Refining Co., 120 Broadway, New York 5.

LETTERS (Pattern)
Wellman Products Co., 1444 E. 49th St., Cleveland 3, O.

LIGHTING FIXTURES
Midwest Lighting Products Co., 1337 Beach Parkway, Cleveland 7, Ohio

LOADERS
Clearfield Machine Co., Clearfield, Pa.
National Engineering Co., 549 W. Washington St., Chicago 6, Ill.

LUBRICANTS (Industrial)
Smith Oil & Refining Co., 1102 Kilburn Ave., Rockford, Ill.
Swan-Finch Oil Corp., R. C. A. Bldg., West, New York 26, N. Y.
United States Graphite Co., Saginaw, Mich.

LUMBER (All kinds)
Dougherty Lumber Co., 4300 East 68th St., Cleveland 5, O.

MACHINE KEYS
Standard Horse Nail Corp., New Brighton, Pa.

MAGNESIUM (Ingots)
Apex Smelting Co., 2534 Filmore St., Chicago 12, Ill.

MAGNET CONTROLLERS
Ohio Electric Mfg. Co., 5906 Maurice Ave., Cleveland, Ohio.

MAGNET GENERATORS
Power Plants Inc., 1755 E. 33rd St., Cleveland 14, Ohio.

MAGNETS
Dings Magnetic Separator Co., 4740 W. McGeough, Milwaukee 7, Wis.
Ohio Electric Mfg. Co., 5906 Maurice Ave., Cleveland, Ohio.
Stearns Magnetic Mfg. Co., 662 S. 28th St., Milwaukee 4, Wis.

MANGANESE (Briquets)
Electro Metallurgical Sales Corp., 30 E. 42nd St., New York 17, N. Y.

MATCHPLATES
Champion Foundry & Machine Co., 1314 W. 21st St., Chicago 8, Ill.
City Pattern Foundry & Machine Co., 1161 Harper Ave., Detroit 11, Mich.
Hines Flask Co., 1324 Hird Ave., Cleveland 7, O.
Master Pattern Co., 1315 Main Ave., Cleveland, Ohio
Plaster Process Castings Co., 6922 Carnegie Ave., Cleveland 3, O.
Pressure Cast Products Co., 1028 Vermont Ave., Detroit 16, Mich.
Scientific Cast Products Corp., 1388-92 E. 40th St., Cleveland 3, O.

MATERIALS HANDLING
Hughes-Keenan Co., Mansfield, Ohio

MECHANICAL ENGINEERS
Engineering Service Inc., 610 West Michigan St., Milwaukee 3, Wis.
Giffels & Vallet, Inc., Marmette Bldg., Detroit, Mich.
Lester B. Knight & Associates, Inc., 600 West Jackson Blvd., Chicago 3, Ill.
Williams and Hansen, 744 No. 4th St., Milwaukee 3, Wis.

MELTING POTS
Acme Foundry Co., Detroit 16, Mich.

METAL CLEANING EQUIPMENT
American Wheelabrator & Equipment Co., Mishawaka, Ind.
N. Ransohoff, Inc., 208 W. 71st St., Cincinnati 16, O.

METALLOGRAPHIC EQUIPMENT
Buehler Ltd., 228 N. LaSalle St., Chicago 1, Ill.
Harry W. Dietert Co., 9330A Roselawn Ave., Detroit 4, Mich.
Precision Scientific Co., 3737 Courtland St., Chicago 47, Ill.

METALLURGISTS
Associated Engineers Inc., 230 E. Berry St., Fort Wayne 2, Ind.
Crobough Co., Frank L., Blackstone Bldg., Cleveland, Ohio.
W. G. Reichert Engineering Co., 1060 Broad St., Newark, N. J.

METERS (Gas, Air, Water)
Illinois Testing Laboratories, Inc., 420 N. LaSalle St., Chicago 10, Ill.
Roots-Connersville Blower Corp., Connersville, Ind.

MICROSCOPES
Buehler, Ltd., 228 N. LaSalle, Chicago 1, Ill.

MIXERS (Core Wash)
Federal Foundry Supply Co., 4600 E. 71st St., Cleveland 5, O.

MIXERS (Sand and Clay)
American Wheelabrator & Equipment Co., 505 S. Byrkit St., Mishawaka, Ind.
Beardsley & Piper Co., The, 2424 No. Cicero, Chicago 39, Ill.
Blystone Division, Standard Sand & Machine Co., 549 W. Washington St., Chicago 6, Ill.
Clearfield Machine Co., Clearfield, Pa.
Construction Machinery Co., Waterloo, Iowa.
Freeman Supply Co., 1152 Broadway Toledo 5, O.
Jeffrey Mfg. Co., 907 N. Fourth St., Columbus 16, O.
National Engineering Co., 549 W. Washington St., Chicago 6, Ill.
Royer Foundry & Machine Co., Kingston, Pa.

MODELS (Wood)
Master Pattern Co., 1315 Main Ave., Cleveland, Ohio

MOLD CONVEYORS
Bartlett & Snow, C. O., Co., 6201 Harvard Ave., Cleveland 5, O.
Beardsley & Piper Co., The, 2424 No. Cicero, Chicago 39, Ill.
Cleveland Tramrail Div. of Cleveland Crane & Engineering Co., Wickliffe, Ohio.
Jeffrey Mfg. Co., 907-99 N. Fourth St., Columbus 16, O.
Link Belt Co., 300 W. Pershing Rd., Chicago 9, Ill.
Logan Co., 580 Cabel, Louisville, Ky.
Mathews Conveyer Co., Ellwood City, Pa.
National Engineering Co., 549 W. Washington St., Chicago 6, Ill.
Newaygo Engineering Co., Newaygo, Mich.
Osborn Mfg. Co., 5401 Hamilton Ave., Cleveland 14, O.
Roto-Cast Foundry Equipment Inc., 100 Grand St., Coldwater, Mich.

MOLD DRYERS
Carl-Mayer Corp., 3030 Euclid Ave., Cleveland 15, Ohio.
Despatch Oven Co., Minneapolis 14, Minn.
Porbeck Mfg. Co., 2600 N. 9th St., St. Louis, Mo.

MOLD OVENS and DRYERS
Carl-Mayer Corp., 3030 Euclid Ave., Cleveland 15, Ohio.
Despatch Oven Co., Minneapolis 14, Minn.
Foundry Equipment Co., Cleveland 13, O.
Lanly Company, 750 Prospect Ave., Cleveland 15, O.
Maehler, Paul, Co., 2200 W. Lake St., Chicago 12, Ill.
Porbeck Mfg. Co., 2600 N. 9th St., St. Louis, Mo.
Young Bros. Co., 6508 Mack Ave., Detroit 7, Mich.

MOLD TRUCKS (Power Operated)
Clark Tructractor Div. of Clark Equipment Co., Battle Creek, Mich.

MOLDING MACHINES
Adams Co., Dubuque, Iowa.
Arcade Manufacturing Div. Rockwell Mfg. Co., Freeport, Ill.
Beardsley & Piper Co., The, 2424 N. Cicero, Chicago 39, Ill.
Berkshire Mfg. Co., 1111 Power Ave., Cleveland 14, O.
Champion Foundry & Machine Co., 1314 W. 21st St., Chicago 8, Ill.
Davenport Machine & Foundry Co., Davenport, Iowa.

MOLDING MACHINES (cont'd)

Haynes Foundry Equipment Co., 814 Ada St., Kalamazoo 21, Mich.
Herman Pneumatic Machine Co., Union Bank Bldg., Pittsburgh 22, Pa.
International Molding Machine Co., 2608 W. 16th St., Chicago 8, Ill.
Johnston & Jennings Co., 867 Addison Rd., Cleveland 14, O.
Milwaukee Foundry Equipment Co., 3238 W. Pierce St., Milwaukee 4, Wis.
Moline Iron Works, 228 Second St., Moline, Ill.
Nicholls, Wm. H., Co., Richmond Hill, Long Island 18, N. Y.
Osborn Mfg. Co., 5401 Hamilton Ave., Cleveland 14, O.
Pioneer Mfg. Co., West Allis, Wis.
S. P. O. Incorporated, 7500 Grand Division Ave., Cleveland 5, O.
Tabor Mfg. Co., 6225 Tacony St., Philadelphia 35, Pa.

MOLDING MACHINES (Jolt)

Adams Co., Dubuque, Iowa.
Champion Foundry & Machine Co., 1314 W. 21st St., Chicago 8, Ill.
Davenport Machine & Foundry Co., Davenport, Iowa.
Haynes Foundry Equipment Co., 814 Ada St., Kalamazoo 21, Mich.
Herman Pneumatic Machine Co., Union Bank Bldg., Pittsburgh 22, Pa.
International Molding Machine Co., 2608 W. 16th St., Chicago 8, Ill.
Johnston & Jennings Co., 867 Addison Rd., Cleveland 14, O.
Milwaukee Foundry Equipment Co., 3238 W. Pierce St., Milwaukee 4, Wis.
Nicholls, Wm. H., Co., Richmond Hill, Long Island 18, N. Y.
Osborn Mfg. Co., 5401 Hamilton Ave., Cleveland 14, O.
S. P. O. Incorporated, 7500 Grand Division Ave., Cleveland 5, O.

MOLDING MACHINES (Rollover)

Champion Foundry & Machine Co., 1314 W. 21st St., Chicago 8, Ill.
Davenport Machine & Foundry Co., Davenport, Iowa.
Herman Pneumatic Machine Co., Union Bank Bldg., Pittsburgh 22, Pa.
International Molding Machine Co., 2608 W. 16th St., Chicago 8, Ill.
Johnston & Jennings Co., 867 Addison Rd., Cleveland 14, O.
Milwaukee Foundry Equipment Co., 3238 W. Pierce St., Milwaukee 4, Wis.
Nicholls, Wm. H., Co., Richmond Hill, Long Island 18, N. Y.
Osborn Mfg. Co., 5401 Hamilton Ave., Cleveland 14, O.
S. P. O. Incorporated, 7500 Grand Division Ave., Cleveland 5, O.
Sutter Products Co., Dearborn, Mich.

MOLDING MACHINES (Squeeze)

Adams Co., Dubuque, Iowa.
Champion Foundry & Machine Co., 1314 W. 21st St., Chicago 8, Ill.
Davenport Machine & Foundry Co., Davenport, Iowa.
Haynes Foundry Equipment Co., 814 Ada St., Kalamazoo 21, Mich.
Herman Pneumatic Machine Co., Union Bank Bldg., Pittsburgh 22, Pa.
International Molding Machine Co., 2608 W. 16th St., Chicago 8, Ill.
Johnston & Jennings Co., 867 Addison Rd., Cleveland 14, O.
Milwaukee Foundry Equipment Co., 3238 W. Pierce St., Milwaukee 4, Wis.
Moline Iron Works, 228 Second St., Moline, Ill.
Nicholls, Wm. H., Co., Richmond Hill, Long Island 18, N. Y.
Osborn Mfg. Co., 5401 Hamilton Ave., Cleveland 14, O.
S. P. O. Incorporated, 7500 Grand Division Ave., Cleveland 5, O.

MOLDING SANDS

Great Lakes Foundry Sand Co., United Artists Bldg., Detroit 26, Mich.
Ottawa Silica Co., Ottawa, Ill.
Standard Silica Corp., 209 So. LaSalle St., Chicago 4, Ill.
Wedron Silica Co., 38 So. Dearborn St., Chicago, Ill.

MOLD WASH

Federal Foundry Supply Co., 4600 E. 71st St., Cleveland 5, O.
National Carbon Co., Inc., Carbon Products Div., 30 E. 42nd St., New York 17, N. Y.
United States Graphite Co., Saginaw, Mich.

MOLYBDENUM

Molybdenum Corporation of America, Pittsburgh 19, Pa.

MONORAIL SYSTEMS

American Monorail Co., 13104 Athens Ave., Cleveland 7, O.
Cleveland Tramrail Div. of Cleveland Crane & Engineering Co., 1155 East 283rd St., Wickliffe, O.
Link Belt Co., 300 W. Pershing Rd., Chicago 9, Ill.
Modern Equipment Co., Port Washington, Wis.

MOTORS (Electric)

Allis-Chalmers Mfg. Co., Milwaukee 1, Wis.

NAILS (Chill)

Bethlehem Steel Co., Bethlehem, Pa.
Republic Steel Corp., Cleveland 4, O.
Standard Horse Nail Corp., New Brighton, Pa.

NICKEL

International Nickel Co., Inc., 67 Wall St., New York City 5.

NOZZLES (Blasting)

Alloy Metal Abrasives Co., 311 W. Huron St., Ann Arbor, Mich.
American Wheelabrator & Equipment Co., 505 S. Byrkit St., Mishawaka, Ind.
Davenport Machine & Foundry Co., Davenport, Iowa.
Federal Foundry Supply Co., 4600 E. 71st St., Cleveland 5, O.
Norton Co., Worcester 6, Mass.
Pangborn Corp., Hagerstown, Md.
W. W. Sly Mfg. Co., 4753 Train Ave., Cleveland 2, O.

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Whiting Corp., 15607 Lathrop Ave., Harvey, Ill.
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OVENS (Core) (See CORE OVENS)

OVENS (Enameling, Japanning)

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Tamms Silica Co., 228 N. LaSalle St., Chicago 1, Ill.

SKIP HOISTS

Beardsley & Piper Co., The, 2424 No. Cicero, Chicago 39, Ill.
Gardner-Denver Co., Gardner Drive, Quincy, Ill.
Link Belt Co., 300 W. Pershing Rd., Chicago 9, Ill.
National Engineering Co., 549 W. Washington St., Chicago 6, Ill.
Whiting Corporation, 15607 Lathrop Ave., Harvey, Ill.

SLIP FLASKS

Adams Co., Dubuque, Iowa.
Hines Flask Co., 1324 Hird Ave., Cleveland 7, O.

SLINGS (Chain)

Jeffrey Mfg. Co., 907 N. Fourth St., Columbus 16, O.
Link Belt Co., 300 W. Pershing Rd., Chicago 9, Ill.
S. G. Taylor Chain Co., Hammond, Ind.

SLIP JACKETS

Adams Co., Dubuque, Iowa.
Chicago Mfg. & Distributing Co., 1928 W. 46th St., Chicago 9, Ill.
Federal Foundry Supply Co., 4600 E. 71st St., Cleveland 5, O.
Freeman Supply Co., 1152 Broadway, Toledo 5, O.
Fremont Flask Co., Fremont, O.
Hines Flask Co., 1324 Hird Ave., Cleveland 7, O.

SMELTERS & REFINERS

American Smelting & Refining Co., 120 Broadway, New York 5.
Niagara Falls Smelting & Refining Corp., 2204 Elmwood Ave., Buffalo 17, N. Y.

SNAGGING WHEELS—See **ABRASIVE WHEELS**

SNAP FLASKS

Adams Co., Dubuque, Iowa.
Diamond Clamp & Flask Co., Richmond, Ind.
Hines Flask Co., 1324 Hird Ave., Cleveland 7, O.

SODA ASH

Mathieson Alkali Works, Inc., 60 E. 42nd St., New York 17, N. Y.

SOLDER

American Smelting & Refining Co., 120 Broadway, New York 5.

SPACE HEATERS

Dravo Corporation, Neville Island, Pittsburgh 25, Pa.

SPECIAL FOUNDRY ALLOYS

Vanadium Corp. of America, 420 Lexington Ave., New York, N. Y.

SPIEGELEISEN

Electro Metallurgical Sales Corp., 30 E. 42nd St., New York 17, N. Y.

SPRAY GUNS

Murphy & Co., Jas. A., Hamilton, O.
New Haven Vibrator Co., 131 Chestnut St., New Haven 7, Conn.

SPRUE CUTTERS

Adams Co., Dubuque, Iowa.
Freeman Supply Co., Toledo 5, O.
Milwaukee Chaplet & Mfg. Co., 1023 S. 40th St., Milwaukee, Wis.

STEEL (High Speed)

Bethlehem Steel Co., Bethlehem, Pa.

STEEL (Structural)

American Bridge Co., Pittsburgh 19, Pa.

STRIPPING MACHINES
Adams Co., Dubuque, Iowa.
Champion Foundry & Machine Co., 1314 W. 21st St., Chicago 8, Ill.
Davenport Machine & Foundry Co., Davenport, Iowa.
International Molding Machine Co., 2608 W. 16th St., Chicago 8, Ill.
Milwaukee Foundry Equipment Co., 3238 W. Pierce St., Milwaukee, Wis.

SURFACE TREATMENT METALS
N. Ransohoff, Inc., 208 W. 71st St., Cincinnati 16, O.

TAPER PINS
Standard Horse Nail Corp., New Brighton, Pa.

TEMPERATURE CONTROLLERS
Illinois Testing Laboratories, 418 N. LaSalle St., Chicago 10, Ill.
Marshall Co., L. H., 270 W. Lane Columbus 1, O.

TESTING EQUIPMENT
Detroit Testing Machine Co., 19390 Grinnell Ave., Detroit 13, Mich.

TESTING LABORATORIES
Harry W. Dietert Co., 9330A Roselawn Ave., Detroit 4, Mich.

TESTING MACHINES (Tensile)
Detroit Testing Machine Co., 19390 Grinnell Ave., Detroit 13, Mich.

THERMOCOUPLES
Illinois Testing Laboratories, 418 N. LaSalle St., Chicago 10, Ill.
Marshall Co., L. H., 270 W. Lane, Columbus 1, O.
Tamms Silica Co., 228 N. LaSalle St., Chicago 1, Ill.

TIERING MACHINES (Power)
Clark Tructractor Div. of Clark Equipment Co., Battle Creek, Mich.

TIMERS (Electric)
Herman Pneumatic Machine Co., Union Bank Bldg., Pittsburgh 22, Pa.

TIN
American Smelting & Refining Co., 120 Broadway, New York 5, N. Y.

TONGS
Industrial Equipment Co., Minster, O.

TOOLS, CUTTING (Carbide)
Severance Tool Industries Inc., Saginaw, Mich.

TOOLS (Pneumatic Portable)
Chicago Pneumatic Tool Co., General Offices: 8 East 44th St., New York 17, N. Y.
Cleco Pneumatic Tool Div., Reed Roller Bit Co., Houston, Texas
Dayton Pneumatic Tool Co., Dayton 1, O.
Gardner-Denver Co., Gardner Drive, Quincy, Ill.
Independent Pneumatic Tool Co., 600 West Jackson Blvd., Chicago 6, Ill.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.
Joy Mfg. Co., Sullivan Division, Michigan City, Ind.
Schramm Inc., West Chester, Pa.

TORCHES and BURNERS (Acetylene, gas, oil)
Freeman Supply Co., Toledo 5, O.
North American Mfg. Co., 4455 E. 71st St., Cleveland 4, O.

TOTE BOXES (see "BOXES-TOTE")

TRACTORS (Gas Powered)
Clark Tructractor Div. of Clark Equipment Co., Battle Creek, Mich.

TRAMRAIL SYSTEMS
American MonoRail Co., 13104 Athens Ave., Cleveland 7, O.
Cleveland Tramrail Div. of Cleveland Crane & Engineering Co., 1155 East 283rd St., Wickliffe, O.

TRAMRAIL SYSTEMS (Cont'd.)
Link Belt Co., 300 W. Pershing Rd., Chicago 9, Ill.
Modern Equipment Co., Port Washington, Wis.

TROLLEYS
Curtis Pneumatic Machinery Co., 1922 Kienlen Ave., St. Louis 20, Mo.
Modern Equipment Co., Port Washington, Wis.

TRUCK BATTERIES (Industrial)
Electric Storage Battery Co., Allegheny Ave. at 19th St., Philadelphia 3, Pa.

TRUCK CRANES
Hughes-Keenan Co., Mansfield, Ohio

TRUCKS (Dump)
Phillips Mine & Mill Supply Co., 2227 Jane St., Pittsburgh 3, Pa.

TRUCKS (Industrial)
Buda Company, Harvey, Ill.

TRUCKS (Power Lift)
Clark Tructractor Div. of Clark Equipment Co., Battle Creek, Mich.

TRUCK WHEELS
Sterling Wheelbarrow Co., 7100 W. Walker St., Milwaukee 14, Wis.

TUBES (Annealing)
Pressed Steel Co., Wilkes-Barre, Pa.

TUMBLING BARRELS
Cleveland Chaplet & Mfg. Co., 1197 West 67th St., Cleveland 2, O.
Haynes Foundry Equipment Co., 814 Ada St., Kalamazoo 21, Mich.
N. Ransohoff Inc., 208 W. 71st St., Cincinnati 16, O.
Sly Mfg. Co., W. W., 4753 Train Ave., Cleveland 2, O.
Tabor Mfg. Co., 6225 Tacony St., Philadelphia 35, Pa.
Whiting Corporation, 15607 Lathrop Ave., Harvey, Ill.

TURNTABLES
Beardsley & Piper Co., The 2424 No. Cicero, Chicago 39, Ill.
Modern Equipment Co., Port Washington, Wis.
Newaygo Engineering Co., Newaygo, Mich.
Roto-Cast Foundry Equipment Inc., 100 Grand St., Coldwater, Mich.
Whiting Corporation, 15607 Lathrop Ave., Harvey, Ill.

UNIT HEATERS
Dravo Corp., Neville Island, Pittsburgh 25, Pa.

UNLOADERS (Portable-Gas, Electric)
Bosworth Engineering Co., 6723 Denison Ave., Cleveland, Ohio.

VALVES (Air, Water, Steam)
Air-Way Pump & Equipment Co., 405 S. Jefferson St., Chicago 7, Ill.
Cleveland Vibrator Co., 2828 Clinton Ave., W., Cleveland 13, Ohio.
North American Mfg. Co., 4455 E. 71st St., Cleveland 4, O.
R-S Products Corp., 4530 Germantown Ave., Philadelphia 44, Pa.

VALVES (Adjustable Orifice)
North American Mfg. Co., 4455 E. 71st St., Cleveland 4, Ohio.

VALVES (Blow-off and Cut-off)
Champion Foundry & Machine Co., 1314 W. 21st St., Chicago 8, Ill.
Cleveland Vibrator Co., 2828 Clinton Ave., W., Cleveland 13, Ohio.
Wm. H. Nichols Co., Richmond Hill, Long Island 18, N. Y.

VENTILATING SYSTEMS
American Wheelabrator & Equipment Co., 505 S. Byrkit St., Mishawaka, Ind.
Joy Mfg. Co., La-Del Division, New Philadelphia, Ohio.
Newcomb-Detroit Co., Inc., 5741 Russell St., Detroit 11, Mich.
Pangborn Corp., Hagerstown, Md.
Schneible Co., Claude B., 2827—25th St., Detroit 16, Mich.
Swartwout Co., 18511 Euclid Ave., Cleveland 15, Ohio.
W. W. Sly Mfg. Co., 4753 Train Ave., Cleveland 2, O.

VENTILATORS (Roof)
Swartwout Co., 18511 Euclid Ave., Cleveland 15, Ohio.

VENTS (Core Box)
Champion Foundry & Machine Co., 1314 W. 21st St., Chicago 8, Ill.
Demmler & Bros., Wm., Kewanee, Ill.
C. M. Smillie & Co., 1100 Woodward Hgts. Blvd., Ferndale, Mich.

VIBRATORS
Adams Co., Dubuque, Iowa.
Beardsley & Piper Co., The, 2424 No. Cicero, Chicago 39, Ill.
Cannon Vibrator Co., 111 Power Ave., Cleveland 14, Ohio.
Cleveland Vibrator Co., 2828 Clinton Ave., W., Cleveland 13, Ohio.
Davenport Machine & Foundry Co., Davenport, Iowa.
Foundry Supplies & Mfg. Co., 2221 Orchard St., Chicago 14, Ill.
Freeman Supply Co., 1152 Broadway, Toledo 5, O.
Herman Pneumatic Machine Co., Union Bank Bldg., Pittsburgh 22, Pa.
Link Belt Co., 300 W. Pershing Rd., Chicago, Ill.
Martin Engineering Co., Kewanee, Ill.
Milwaukee Foundry Equipment Co., 3238 W. Pierce St., Milwaukee, Wis.
New Haven Vibrator Co., 131 Chestnut St., New Haven 7, Conn.
Nichols Co., Wm. H., Richmond Hill, Long Island 18, N. Y.
Osborn Mfg. Co., 5401 Hamilton Ave., Cleveland 14, O.
S P O Incorporated, 7500 Grand Division Ave., Cleveland 5, O.
Syntron Company, Homer City, Pa.
Tabor Mfg. Co., 6225 Tacony St., Philadelphia 35, Pa.

VIBRATORS (Core Bench)
Cleveland Vibrator Co., 2828 Clinton Ave., W., Cleveland 13, Ohio.

VISES (Air Operated)
Van Products Co., Erie, Pa.

WARM AIR HEATERS
Dravo Corp., Neville Island, Pittsburgh 25, Pa.

WASH ROOM EQUIPMENT
Bradley Washfountain Co., Box 732, Milwaukee 1, Wis. Milwaukee, Wis.

WAX (Core, Vent, Pattern)
PMS Co., 1701 Power Ave., Cleveland 14, O.
United Compound Co., Inc., 328 South Park Ave., Buffalo 4, N. Y.

WEDGES (Foundry)
Chicago Mfg. & Distributing Co., 1928 W. 46th St., Chicago 9, Ill.
Sterling Wheelbarrow Co., 7100 W. Walker St., Milwaukee 14, Wis.

WELDING GAS
Air Reduction Sales Co., 60 East 42nd St., New York 17, N. Y.

WELDING APPARATUS (Electric Arc)
Allis Chalmers Mfg. Co., Milwaukee 1, Wis.
Air Reduction Sales Co., 60 East 42nd St., New York 17, N. Y.
Harnischfeger Corp., 4411 W. National Ave., Milwaukee 14, Wis.
Metallizing Company of America, 1330 W. Congress St., Chicago 7, Ill.

WELDING and CUTTING APPARATUS and SUPPLIES
Air Reduction Sales Co., 60 East 42nd St., New York 17, N. Y.

WELDING ELECTRODES (Carbon)
National Carbon Co., Carbon Products Div., 30 E. 42nd St., New York 17, N. Y.

WELDING RODS & ELECTRODES
Air Reduction Sales Co., 60 East 42nd St., New York 17, N. Y.
International Nickel Co., Inc., 67 Wall St., New York 5, N. Y.
Metallizing Company of America, 1330 W. Congress St., Chicago 7, Ill.

WHEELBARROWS
Construction Machinery Corp., Waterloo, Iowa.
Sterling Wheelbarrow Co., 7100 W. Walker St., Milwaukee 14, Wis.

WHEELS, ABRASIVE (Cut-off)
Bay State Abrasive Products Co., Westboro, Mass.
Bridgeport Safety Emery Wheel Co. Inc., Bridgeport, Conn.
Carborundum Co., Perth Amboy, N. J.
Electro Refractories & Alloys Corp., Vars Bldg., Buffalo 2, N. Y.
Independent Pneumatic Tool Co., 600 West Jackson Blvd., Chicago 6, Ill.
Keystone Abrasive Wheel Co., Camegie, Pa.
Raybestos Manhattan, Inc., Manhattan Rubber Division, Passaic, N. J.
Norton Company, Worcester 6, Mass.
Peninsular Grinding Wheel Co., 729 Meldrum Ave., Detroit, Mich.
Simonds Abrasive Co., Tacony & Fraley Sts., Philadelphia 37, Pa
Sterling Grinding Wheel Division, Cleveland Quarries Co., Tiffin, Ohio.

WHEELS (Wire)
Osborn Mfg. Co., 5401 Hamilton Ave., Cleveland 14, O.

WIRE BRUSHES
Independent Pneumatic Tool Co., 600 West Jackson Blvd., Chicago 6, Ill.
Osborn Mfg. Co., 5401 Hamilton Ave., Cleveland 14, O.

WIRE NAILS
Republic Steel Corp., Cleveland 4, O.

WOOD FLOUR
Ace Foundry Materials Co., 14611 Fenkell Ave., Detroit 27, Mich.

WOODWORKING MACHINERY
Do All Company, Des Plaines, Ill.
Freeman Supply Co., 1152 Broadway, Toledo 5, O.
Oliver Machinery Co., Grand Rapids 2, Mich.

X-RAY EQUIPMENT
Allis Chalmers Mfg. Co., Milwaukee 1, Wis.

X-RAY FILMS
Eastman Kodak Co., Rochester, N. Y.

ZINC
American Smelting & Refining Co., 120 Broadway, New York 5, N. Y.

Classified Advertising

Help Wanted

FOUNDRY FOREMEN

For well-established and highly mechanized productive gray iron foundry located in the south, producing quality automotive, appliance and other small commercial castings.

CORE ROOM FOREMAN—Experienced with full knowledge of bench and blown core work.
CUPOLA FOREMAN—To take complete charge of cupola, having sound experience in raw materials and the supervision of charging, melting and cupola lining.

2 FOUNDRYMEN—Well qualified with thorough knowledge of jolt squeezer and rollover work, gating and risering.

Above men must be fully qualified with ability to get quality and quantity work done while getting along with men.

Ours is a very progressive organization needing additional supervisors due to a just completed expansion program.

Pleasant working conditions and promotional opportunities limited only by your own ability. In reply, give details, experience, ability and work background covering at least 10 years. Also give references and salary expected. Only qualified men, young to medium age, need apply.

BOX 437
THE FOUNDRY CLEVELAND 13, OHIO

WORKS MANAGER

Take full charge of an aluminum and brass foundry, also operating a modern machine shop, located in the South. Must be able to get along with southerners and be willing to undergo a rigid inves'igation before hiring. Send full information. Salary $7000 to $10,000 per year.

THE ENGINEERING AGENCY, INC.
EST. 1893
53 W. JACKSON BLVD.
CHICAGO 4, ILL.

GENERAL FOREMAN

To assume complete charge of brass foundry including melting, molding, core machine, grinding and cleaning. A go-getter wanted, ability to handle men and to follow instructions and controls of primary importance. Knowledge of pressure goods desirable—location East.

BOX 461
THE FOUNDRY CLEVELAND 13, OHIO

SALES REPRESENTATIVE

Highly reputable and well established supplier of foundry raw materials has openings in Ohio and Ontario, Canada for alert young man possessing foundry experience. Technical school graduate preferred. Details submitted about self and experience will be re'ained in confidence. Address: Box 474, The FOUNDRY, Cleveland 13, Ohio.

SALESMAN

Increased production of a revolutionary type light for foundries offers able opportunity for large profits and satisfied customers. See advertisement on page 141 of this magazine. Many exclusive territories available. Address: MIDWEST LIGHTING PRODUCTS CO., 1337 BEACH PARKWAY, CLEVELAND 7, OHIO.

SALES ENGINEER

Required by established manufacturer of pneumatic tools. Prefer man with established non-competitive allied lines. Exclusive territory-commission basis. Address: MASTER PNEUMATIC TOOL COMPANY, INC., 2100 KEITH BLDG., CLEVELAND, OHIO.

EXECUTIVE FOUNDRY CONSULTANT

Foundry engineering firm seeks a thoroughly seasoned foundryman with engineering education to act as consultant in the gray iron industry. Some traveling. Write in detail with full information. Strictly confidential. No references contacted without your permission. Address: Box 470, The FOUNDRY, Cleveland 13, Ohio.

SALES PROMOTION

EXPERIENCED SALESMAN TO INTRODUCE NEW CORE BINDERS AND PASTES TO FOUNDRY INDUSTRY; ABILITY TO START SALES PROMOTION PROGRAM FROM BEGINNING. SUBMIT EXPERIENCE RECORD, SALARY EXPECTED AND ENCLOSE SNAPSHOT. ADDRESS: BOX 444, THE FOUNDRY, CLEVELAND 13, OHIO.

Help Wanted

FOUNDRY MANAGER

Gray iron foundry in Midwestern city of 100,000 population, pouring 15 tons per day. Capital inves'ment of $15,000 (28%) available, if desired. Excellent opportunity because of contemplated expansion program. Must be experienced and capable of taking complete charge.

BOX 440
THE FOUNDRY CLEVELAND 13, OHIO

EXPERIMENTAL COREMAKER

Man to take complete charge of short order (less than 75 lbs.) and small experimental castings in stainless steel foundry. Must be capable of doing own rigging for dry sand, coremaking, assembly, rough inspection and keep own records. Would be separated from production work except for pouring and cleaning. Interesting opportunity to build up department with great possibilities for right man. Modern plant with complete laboratory facilities, etc. in Illinois University town. Write details of qualifications, salary expected, etc. Address: Box 478, The FOUNDRY, Cleveland 13, Ohio.

METALLURGIST

Grey iron and semi-steel foundry now being mechanized desires to employ metallurgist to handle cupola and sand controls and such other work as is customary. Prefer young man with some experience in mechanized foundry. Permanent position. South-Central Pennsylvania location. Address: Box 403, The FOUNDRY, Cleveland 13, Ohio.

MANUFACTURER'S AGENT

Contacting foundries to handle well established line of sound 50-year old manufacturer. Man must be reputable and dependable. Address: Box 472, The FOUNDRY, Cleveland 13, Ohio.

FOUNDRY
PRODUCTION FOREMAN

Permanent position, good salary for competent, experienced foundryman with large, expanding gray iron foundry. Give complete background in letter. Address: Box 416, The FOUNDRY, Cleveland 13, Ohio.

SUPERINTENDENT

Active practical foundryman, technically trained in modern foundry practice. Experience must cover Semi-Steel and alloy iron castings, heavy to light, in green and dry sand and all core molds. Must know rigging and gating for economical production on machines. Wonderful opportunity for right man, Chicago Area. Address: Box 454, The FOUNDRY, Cleveland 13, Ohio.

PRODUCTION ENGINEER

Newly established modern foundry with division for soil-pipe foundry and high pressure motor-blocks seeks qualified production engineer. Address: KRISTIANSANDS JERNSTOPERI A/S, KRISTIANSAND S., NORWAY.

MANUFACTURER'S REPRESENTATIVES WANTED

Manufacturer of core oils desires representation throughout the East and Middle West. Persons having actual foundry contacts preferred. Address: Box 468, The FOUNDRY, Cleveland 13, Ohio.

SUPERINTENDENT

Gray iron foundry. General foundry work on machinery light and heavy castings. Advise experience and salary to start. Address: Box 466 The FOUNDRY, Cleveland 13, Ohio.

Help Wanted

FOUNDRYMAN

New steel casting foundry now starting operations require foundryman and practical metal man capable of supervising operation of cupola, refining furnace, core room, molding, etc. Excellent opportunity. Write stating age, experience, qualifications, references and salary desired.
HARTLAND STEEL AND FOUNDRY CORP.
WEATHERLY, PA.

Positions Wanted

GENERAL MANAGER

With long valuable experience in managing, building up and maintaining foundry and machinery business on profitable basis, invites correspondence preliminary to interview. Ability to direct all office, sales, financial and production activities efficiently and economically unquestionably established by previous record. Address: Box 476, The FOUNDRY, Cleveland 13, Ohio.

STEEL FOUNDRY MANAGER
OR
SUPERINTENDENT

Twenty-two years supervisory experience producing carbon, low alloy and high alloy steel castings, starting as molding foreman through to works manager. College degrees in engineering and metallurgy, but primarily a practical foundryman with complete knowledge of all phases of production, modern foundry techniques, laboratory control, heading and gating, furnace operation, molding, heat treatment, cleaning and finishing, maintenance, plant layout, and labor relations. Have increased efficiency, trained men, cut scrap and costs, administered incentive and bonus plans and improved safety record. Capable of assuming complete charge of plant operations. Address: Box 364, The FOUNDRY, Cleveland 13, Ohio.

FOUNDRY EXECUTIVE

Proven ability in scientific management of high alloy steel foundry; in gating practice for fine grain, shrink control, high yield; in production of quality castings at competitive prices; in design of high nickel-chrome alloy components for maximum service life; in cost control, time study, metallurgical control, sand control. Latest foreign ceramic developments in foundry. Established ability to run foundry on economic basis; to handle men without labor trouble. Looking for position with complete control of foundry and engineering where, after abilities proven, can buy interest. Address: Box 437, The FOUNDRY, Cleveland 13, Ohio.

MANAGER-SUPERINTENDENT

Age 47 practical gray iron foundryman technically trained with broad background of 26 years' experience producing quality castings. Experienced in all jobs from molder to superintendent of 200 ton day foundry in general jobbing, machine tool, presure castings and high production light work. Well versed in metal and sand control, rigging machines economically, modern mechanized equipment etc. Returning to New England and would like connection with reliable firm that wants high grade foundryman who will produce results. Must be Eastern States. Address: Box 446, The FOUNDRY, Cleveland 13, Ohio.

SALES ENGINEER (STEEL)

Age 37. Four years of mechanical and metallurgical engineering training (University) plus 18 years of practical experience in molding, core making, heat treating, sand laboratory and sand control and research at a large jobbing foundry. Held supervisory positions in the various departments for the past twelve years. Prefer all sand binders, materials and or foundry equipment. Address: Box 452, The FOUNDRY, Cleveland 13, Ohio.

PATERNMAKER FOREMAN

Mature, widely experienced in designing and constructing wood, metal and composition patterns, large and small for all classes of castings. Can solicit work and estimate cost from drawings, lay out work, make or supervise and set rates. First class mechanic. Can make wood or metal rush jobs in shop. Extended intimate foundry experience machines, core blowing, driers and gating. Address: Box 465, The FOUNDRY, Cleveland 13, Ohio.

PRACTICAL FOUNDRYMAN

With twenty years as assistant foundry superintendent on electrical steel, open hearth steel, gray iron and semi-steel. At present foundry superintendent. Age 57, married. Reference if desired. Address: Box 455, The FOUNDRY, Cleveland 13, Ohio.

Classified Advertising

Positions Wanted

FOUNDRYMAN

Married, age 31, college engineering background, five years' sales experience, six years' engineering experience, experience in production and jobbing foundries who believes the foundry industry holds a future for him would like to associate himself with a progressive, medium-sized foundry in mid-west or west. Prefer liaison, methods, planning, administrative or similar work. Ability to meet public, handle assignments and follow through, set up own programs, knowledge of systems and procedures. Would consider opening on profit sharing basis or sales with minimum or no traveling. Address: R. L. ADAMS, 2605 36th ST., DES MOINES 10, IOWA.

STEEL MOLDING SUPERVISOR

Fifteen (15) years' experience in foundries. Fourteen (14) years in one shop. Served apprenticeship on brass, iron and steel molding. Have supervised molding, melting, natural bonded and synthetic sand system, sand testing laboratories, roller conveyors, continuous melting, etc. Would like to start with small or new foundry with chance of advancement. Age 35, married. Address: Box 460, The FOUNDRY, Cleveland 13, Ohio.

FOUNDRY FOREMAN OR SUPERINTENDENT

Twenty years in gray iron, hard iron and malleable cupolas. Also experienced in core room, red brass, aluminum bronze and aluminum. Address: Box 442, The FOUNDRY, Cleveland 13, Ohio.

FOUNDRY SUPERINTENDENT

Practical experience in the production of heavy to light machinery castings, dry, green sand and loam. Production work on jolt squeeze, rollover and continuous pouring. Technically trained, specializing in sand control, cupola operation and the production of high tensile iron for pressure castings. Excellent results with labor relations. Married, available at once. Very much interested in middle west and Chicago area. Will go any place. Address: Box 402, The FOUNDRY, Cleveland 13, Ohio.

FOUNDRY SUPERINTENDENT

With 18 years of sound practical and executive experience covering jobbing or fully mechanized ferrous operations available after June 15th. Address: Box 441, The FOUNDRY, Cleveland 13, Ohio.

MASTER MECHANIC

Master mechanic and maintenance head of foundry. Thirteen years' experience. Reliable references gladly furnished. Address: Box 427, The FOUNDRY, Cleveland 13, Ohio.

SALESMAN
SUPPLIES, EQUIPMENT

Specializing binders 16 years. Mature years. Nation wide experience. Salary and expenses. Address: Box 390, The FOUNDRY, Cleveland 13, Ohio.

MASTER MECHANIC

Desires connection with large modern foundry. Twenty-five years practical experience in supervising installation and maintenance in complete sand handling equipment, specializing in designing modern labor saving devices and development of higher production in gray iron, brass and aluminum foundries. Address: Box 477, The FOUNDRY, Cleveland 13, Ohio.

FOUNDRY SUPERINTENDENT

Practical thoroughly experienced technically trained. Twenty-five years in full charge of gray iron jobbing and production foundries making high grade light and heavy machinery castings. Well versed in metallurgy and all modern methods. Address: Box 464, The FOUNDRY, Cleveland 13, Ohio.

FOUNDRY ENGINEER

Desires position with a steel or brass foundry as foundry engineer or similar capacity. Age 30. Seven years' experience assisting foundries in producing satisfac ory castings. Please address: Box 451, The FOUNDRY, Cleveland 13, Ohio.

PATTERN SHOP FOREMAN
OR PATTERN ENGINEER

Twenty-five years' experience as wood patternmaker including five years as a foreman. Capable of layout work and planning equipment. Address: Box 456, The FOUNDRY, Cleveland 13, Ohio.

Positions Wanted

GRAY IRON FOUNDRYMAN

Practical foundryman with technical training. Thirty-two years' experience, including fifteen years of supervision. Well versed in all phases of jobbing and production work on light and medium castings. Considerable experience in nonferrous metals. Ability to handle men. Progressive and up to date in modern methods of production. Capable of taking complete charge of medium size foundry. Available at once. Address: Box 473, The FOUNDRY, Cleveland 13, Ohio.

GRAY IRON FOUNDRYMAN

My services are available for short period engagements to straighten out your metal, sand or production troubles if located in the Eastern states. Address: Box 445, The FOUNDRY, Cleveland 13, Ohio.

Correspondence Course

GOOD FOUNDRYMEN ARE NOT AN ACCIDENT—THEY DO NOT MERELY HAPPEN

Foundrymen who will add the concisely arranged information on mixing, melting, and semi-steel to their store of experience will prove a valuable asset to any firm. Even though you know 90% of what we offer, the remaining 10% may be causing your firm large losses. Our report on your melting may be worth the fee alone. Remember, semi-steel is the purest, hottest and strongest metal made in the cupola. Synopsis free.

MCLAIN'S SYSTEM INC.
236 E. NORTH AVE.
MILWAUKEE 12, WIS.

Foundries for Sale

PRODUCTION AND JOBBING FOUNDRY

70,000 square feet, for manufacturing gray iron, brass and aluminum castings. Daily capacity 20 tons gray iron, 5 tons nonferrous metal. 60" cupola, jolt squeezers, strippers, rollovers, bumpers, 2 core ovens, large assortment flasks. Going business Pittsburgh district. Address: Box 382, The FOUNDRY, Cleveland 13, Ohio.

FOR SALE
OR
SALE OF CONTROL

Small electric furnace foundry, 75 tons per month capacity. Located Western Pennsylvania. Address: Box 408, The FOUNDRY, Cleveland 13, Ohio.

FOUNDRY FOR SALE

Small gray iron foundry located in Iowa. Fully mechanized. Capacity for 10 to 12 tons daily. Has excellent rail facilities. Main building 100 x 160' and others in fine shape. Complete molding machinery, new American Wheelabrator, sand conditioning equipment, flasks, etc. Fully equipped core room. Bay conveyor. Address: Box 399, The FOUNDRY, Cleveland 13, Ohio.

PRODUCTION FOUNDRY FOR SALE

15,000 sq. ft—5 acres—steel and cement block bldg. 8 jolt squeezers—4 jolt rollovers—2 strippers—Pangborn rotoblast—12 ft. table, 42 in Whiting cupola (capacity 15 to 20 tons per day)—2 core ovens—large assortment of snap flasks. On main highway 30 miles North of Detroit. A going business. Will sell control or 100%.

MR. D. VINCENT
WARDELL SHERATON HOTEL
DETROIT, MICHIGAN

NONFERROUS FOUNDRY

Building and equipment new. Core blower, muller, 4 jolt squeeze machines, 3 furnaces, large core oven along with all the necessary equipment to make the most complete foundry. Approx. $50,000.00 including all inventories. Address: **THE PIONEER FOUNDRY & MFG. CO., P. O. BOX 2388, PHOENIX, ARIZONA.**

Accounts Wanted

CASTING ACCOUNT

STAINLESS STEEL, MEDIUM ALLOY AND CARBON STEEL PREFERABLY WITH MACHINING FACILITIES, BY MAN WITH TWENTY FIVE YEARS' FOUNDRY EXPERIENCE IN PRODUCTION AND SALES IN GULF COAST TERRITORY. ADDRESS: BOX 450, THE FOUNDRY, CLEVELAND 13, OHIO.

MALLEABLE CASTINGS

Successful sales organization of practical foundry engineers now representing leading foundries on carbon steel, stainless steel, grey iron, bronze and aluminum castings in Central and Western New York and Northern Pennsylvania desires representation of high grade production malleable foundry in same territory to round out complete line. Have finest of contac's among industrial users for many years. Address: Box 462, The FOUNDRY, Cleveland 13, Ohio.

Open Capacity

CASTINGS

Grey Iron
10 to 300 lbs.

FISHER & NORRIS
TRENTON, N. J.

OPEN CAPACITY

Have open capacity for aluminum, manganese, brass and bronze cas'ings. Address: NATIONAL FOUNDRY & PATTERN CO., INC., 1440 SUMMER ST., HAMMOND, IND.

OPEN CAPACITY

Squeezer, jobbing, rollover work in grey iron castings. Quality and prompt service assured. Prefer squeezer assignments from mid-west section near our Kansas plant. Address: Box 339, The FOUNDRY, Cleveland 13, Ohio.

OPEN CAPACITY

Gray iron production foundry located in East Tennessee has open capacity for squeezer work. Can furnish up to ten tons per day. Address: Box 397, The FOUNDRY, Cleveland 13, Ohio.

Wanted-To-Buy

SOURCE OF SUPPLY
FOR
LARGE GREY IRON CASTINGS

Weight 2000 lbs. each—requires 9 ft. x 9 ft. flask—core 7½ ft. x 7½ ft. One to five castings per month. Have pattern equipment.

AMERICAN AIR FILTER COMPANY INC.
PURCHASING DEPARTMENT
LOUISVILLE 8, KY.

ELECTRIC FURNACE

Type S or ST Pittsburgh Lectromelt furnace, 3 phase, 60 cycles, 400 to 500 K.V.A. Transformer. Must be in good condition. Address: Box 458, The FOUNDRY, Cleveland 13, Ohio.

WANTED

Dust tight mixer for dry metallic powders—capacity approximately three tons per hour. Preferably with enclosed drive. Address: Box 329, The FOUNDRY, Cleveland 13, Ohio.

WANTED

One Whiting cupola #3½ with blower. Address: Box 467, The FOUNDRY, Cleveland 13, Ohio.

Classified Advertising

Wanted-To-Buy

WANTED TO BUY

Electric steel foundry on West Coast or Southwest. Capacity, approximately 200 tons per month. Address: Box 384, The FOUNDRY, Cleveland 13, Ohio.

WANTED

1 42" or 48" square tumbling mill
1 48" x 72" round tumbling mill
1 24" x 54" round tumbling mill
1 30" x 60" round tumbling mill

State price and condition.

THE MAJESTIC COMPANY
HUNTINGTON, INDIANA

WANTED TO PURCHASE

Completely or the majority interest in a grey iron foundry equipped with molding machine for light production work in Eastern Pennsylvania, New Jersey, New York or Connecticut. Must be reasonably priced. Address: Box 426, The FOUNDRY, Cleveland 13, Ohio.

GREY IRON STOVE PLATE CASTINGS

Large amount of grey stove plate castings including minimum of 10,000 tops. Measuring 21" x 21"; weighing 22 lbs. each. Expected production for year of 1949, 6000 tons. Best pattern equipment will be furnished. In replying describe your equipment and facilities. Will consider foundries who can furnish only part of requirements if they are efficiently equipped. Address: Box 443, The FOUNDRY, Cleveland 13, Ohio.

WANTED

New or used tapping machine for tapping plumbing fittings from 1" to 4" with two or three tapping heads. Pottstown machine preferred. Address: Box 396, The FOUNDRY, Cleveland 13, Ohio.

WANTED

Type AA sand cutter, gas driven, cutting blades 52" wide, outside width of wheels 74". Address: Box 232, The FOUNDRY, Cleveland 13, Ohio.

LABORATORY MIXER WANTED

Small sand mullor (laboratory size) wanted. Might consider small mulbaro-type unit. Address: Box 332, The FOUNDRY, Cleveland 13, Ohio.

MIXERS WANTED

Used Simpson Intensive Sand Mixers. State size, condition and lowest cash price for immediate acceptance. Address Box 578, The FOUNDRY, Cleveland 13, Ohio.

WANTED

Cupola blower for No. 3½ cupola, 3000 c.f.m., 16 oz. pressure, with motor. Address: Box 453, The FOUNDRY, Cleveland 13, Ohio.

WANTED

All sizes tapered aluminum slip or pop-off flasks in good condition with metal jackets if available. State make, size, height of cope and drag, taper, type of pins and price. Address: Box 469, The FOUNDRY, Cleveland 13, Ohio.

GRAY IRON FOUNDRY

Medium size gray iron foundry equipped for machine and squeezer molding for production castings. Any foundry not operating efficiently and profitably to be taken over by two capable foundrymen, with option of purchasing interest in business. Address: Box 463, The FOUNDRY, Cleveland 13, Ohio.

WANTED

International jolt squeezer for stack molding. Give age and price. Address: Box 471, The FOUNDRY, Cleveland 13, Ohio.

Opportunities

OPPORTUNITY

We can furnish empty tight and slack wooden barrels also steel drums for your products. ADDRESS: BUCKEYE COOPERAGE STATION, C.P.O. BOX 1501, CLEVELAND, OHIO.

Employment Service

SALARIED POSITIONS
$2,500-$25,000

This thoroughly organized confidential service of 37 years' recognized standing and reputation carries on preliminary negotiations for supervisory, technical and executive positions of the calibre indicated. Retaining fee protected by refund provision. Identity covered and present position protected. Send only name and address for details.

R. W. BIXBY, INC.
101 Dun Bldg. Buffalo 2, N. Y.

SALARIED PERSONNEL

$3,000—$25,000. This reliable service, established 1927, conducts confidential negotiations for high-grade men who seek a change of connection under conditions assuring, if employed, full protection to present position. Send name and address only for details. Personal consultation invited. Address: JIRA THAYER JENNINGS, DEPT. T, 109 CHURCH STREET, NEW HAVEN, CONN.

For Sale

FOR SALE

Two late model DeWalt radial foundry cut off saws, model ME-2. Excellent condition, at less than half of replacement cost.

R. A. VINE INC.
652 WEST WILLIS AVE. DETROIT, MICH.
TEMPLE 2-6110

METAL RECLAIMING MILL

No. 5 size, a trade in for larger size, used about four years, as is without motor and V belt drive, good condition. Address: DREISBACH ENGINEERING CORP., YONKERS 2, N. Y.

FOR SALE

1—No. 2 Simpson intensive mixer with drive off to side. First class condition. Used very little.
1—Westinghouse Electric furnace. Circular, bell type. 60" dia. x 72" depth. In A-1 condition. Four years old. Complete with extra new spare parts.

BOX 459
THE FOUNDRY CLEVELAND 13, OHIO

FOR SALE

250-stove plate floor flasks good condition with iron interchangeable bars and roll up hinges, best #1 fir lumber. Various sizes. 3-Milwaukee squeezers. 1—Fairbanks Morse air compressor with 7½ horsepower motor in good condition.

KOKOMO BRASS & ALUMINUM FOUNDRY
736 SOUTH DIAMOND STREET
KOKOMO, INDIANA

FOR SALE
SWING TYPE
SANDSLINGER

Beardsley & Piper, serial S.T. 481, 19" head, 4" tip, 20 h.p., 1200 R.P.M. motor in perfect condition.

5-TON ROTARY PLATE FEEDER

Beardsley & Piper, serial F. 110 with motor-reducer & starter, steel frame, hopper for discharging to swingslinger. Perfect condition.

MOLDING MACHINE

#918-B Johnston & Jennings, table 44" x 54", 20" draw, 2,000 lb capacity at 80 lb air pressure. Cost new approximately $3500. Sales Price $1200.

NATIONAL FOUNDRY
CO. OF N. Y., INC.
10 SANDFORD ST. BROOKLYN 5, N. Y.

FOR SALE

(1) LG—9 six foot diameter Pangborn table-blast. Complete unit.
(1) Parblast (Parson Engineering Corp.) cleaning room 10 ft. by 10 ft.—complete.

This equipment is in excellent condition but in excess for the owners present cleaning operation.

BOX 431
THE FOUNDRY CLEVELAND 13, OHIO

FOR SALE

ALL EQUIPMENT REBUILT & GUARANTEED IN STOCK

OVERHEAD ELECTRIC TRAVELING CRANES

TONS	MAKE	SPAN	CURRENT
(2) 1½	Shepard	18'0"	230-VDC.
(2) 3	Case	52'0"	115-VDC.
(1) 5	Northern	14'0"	230-VDC.
(1) 5	Northern	23'11"	440-VAC.
(1) 5	Shaw	30'0"	220-VDC.
(1) 25/5	Niles	80'0"	230-VDC.

ELECTRIC MONORAIL HOISTS

(1)—½-ton American Lo-Hed, 230-VDC.
(6)—½-ton Shepards, 230-VDC., 5-HP. motor HIGH SPEED, FL. OP., 30'0" lift.
(1)—1-ton Shepard, 230-VDC., FL. OP.
SPECIAL: 7½-ton, 2-motor, cage operated, Shepard, 230-VDC., 40'0" lift, enclosed for outdoor service, hoist 28/70-FPM., Trolley 400-FPM., an excellent hoist for scrap yard service or cupola charging.

ALL ABOVE IN STOCK OFFERED REBUILT & GUARANTEED

SEND FOR OUR STOCK LIST OF A.C. & D.C. GENERAL PURPOSE CRANE & MILL MOTORS, ELECTRIC BRAKES & CONTROL EQUIPMENT, MOTOR GENERATOR SETS, TRANSFORMERS, ETC., OF ALL SIZES.

T. B. MACCABE COMPANY
4300 CLARISSA ST.
PHILADELPHIA (40), PENNA.

DUST COLLECTING EQUIPMENT

#4 American dust tube collector; 960 sq. ft. cloth area 12 ft. Sly dust arrestor; 2392 sq. ft. cloth area 9 ft. Sly dust arrestor; 1768 sq. ft. cloth area. All the above are complete with good bags, fans and motors for 220-3-60 current. Complete specifications and prices furnished upon request.

ROBBINS & BOHR
535 CHATTANOOGA BANK BLDG.
CHATTANOOGA 2, TENNESSEE
TELEPHONE 6-0526

FOR SALE

6 new modern Pouring Device Co. ladles 19" top 800# capacity with split hinged cover, trunnions and steading handles. Address: Box 448, The FOUNDRY, Cleveland 13, Ohio.

FOR SALE

1 Cupola.
1 Model #1 American Cleaning Machine.
1 Model # BN-69900 American Table Blast Machine.
2 Schutte & Koerting Tumbling Barrels.
9 13" x 16" Steel Jackets.
1 Master Bench Rammer.
1 Keller Bench Rammer.
1 Wood 11" x 16" Snap Flask.
1 Wood 10" x 20" Snap Flask.
1 Wood 12" x 17" Snap Flask.
1 Surtevant Blower.
5 Milwaukee Molding Machines (Jolt Squeeze).

BILLARD MACHINE & TOOL COMPANY,
MANSFIELD, PENNA.
'PHONE MANSFIELD 44

FOR SALE

84" Diamond surface grinder motor drive with motor in operation.....$3750.00

SHARP TOOL SERVICE COMPANY
5401 WEST LAKE STREET
CHICAGO, ILL.
EST. 1600 MR. P. J. MOONEY

FOR SALE

15 ton OVERHEAD CRANE
90' span

Complete with 204' crane runway. Built 1942.

IRON & STEEL PRODUCTS, INC.
13444 S. Brainard Ave., Chicago 33, Ill.
"ANYTHING containing IRON or STEEL"

FOR SALE

(1) Stedman type "A" 20 x 12" rolling ring crusher—direct motor driven. Drive on right hand side of facing intake hopper. Crusher equipped with Falk type F. A. flexible couplings, also Allen Bradley Magnetic X-Line starter; also feed hopper 10299-E machine No. HM 481. Address: Box 439, The FOUNDRY, Cleveland 13, Ohio.

Classified Advertising

For Sale

(6) Furnaces, box type, electric, Hoskins type FP-252, 220V, 26 KW.
(6) Furnaces, melting, pot type Fisher mod. B.
Furnace, heat treat—elec. "Elec. Furnace Co. 300 KW complete.
Furnace, preheat continuous "Industrial Circ-Air" gas fired, 30" W. x 12' L. including blower (less motor, burner and controls).
Furnace, preheating oven type "American" #1 gas fired 8" W. x 10" H. x 14" L. I. D.
Furnace, heat treat, salt bath elec. "Upton" tank size 80" L. x 44½" W. x 36½" H. including transformer 240 V to 18.4V.
Furnace, preheating, "Industrial" gas fired 46½" x 70" x 50" H. including 4 burners.
Furnace, preheating, "Industrial", gas fired 43½" W. x 39½" D. x 37½" H. (less burners & door).
Furnace, melting—200# capacity "Hausfeld" Mag-St, gas fired stationary type, including burner.
(4) Furnaces, melting—1200# capacity "Hausfeld" Mag-Tilt, gas fired including burner, less lining.
Core machine, Osborn #602.
2 Core Machines, hand rollover, Osborn #42.
Aerator (sand blender) "Jeffrey" #1-30 to 70 ton per hour capacity with steel supports, V belt drive & 7½ HP motor.
Screen, revolving, Palmer Bee, 4' dia. x 9' H. drum including #HD8 speed reducer.
Sand blast cabinet, Sly 8' W. x 8' L. ¼ x 7' 3# H. complete with 6" turntables, motors, exhaust, and controls.
Conveyor, distributing belt type, elevated, Palmer Bee, 182" I., 24" W.—5 ply, 120 FPM including 10 hoppers 18" x 30", 6 hoppers 16" x 18", overflow chute, belt wiper, 170' steel walkway, 5 HP motor and #HD8 speed reducer.
Chip extractor, DeLaval with 3 HP motor.
Sand blast room, "Pangborn" mod. MT-S with 2' 6" x 6' 6" door, complete with floor hopper, bucket type elevator, conveyor, abrasive separator, roto-active table, blast cleaning hose, dust collector, 10 HP, 3 HP and ¾ HP motor and controls.
Also have available machinery for drilling, tapping, milling, grinding, turning, broaching, and sawing, plus one lot of Transite Core Plates in sizes 8 x 8 x ¼ to 30 x 30 x 1.

BOHN ALUMINUM & BRASS CORP.
1400 LAFAYETTE BLDG.
DETROIT, MICH.

FOR SALE

Sandcutting Machines

Two Model S Beardsley & Piper Screenarators—2½ HP, 220 volt, 3 phase, 60 cycle motors. Including extra screens, one spare motor, and misc. spare parts.

Two Royers Model NC-2—3 HP, 220 volt, 3 phase, 60 cycle. Some spare parts.

All above equipment used but in excellent running condition. All available at once.

NORTH JERSEY FOUNDRY CO.
453 MAIN ST.
LITTLE FALLS, N. J.

LINK BELT CONVEYOR

CAR TYPE

In splendid mechanical condition—used less than six months—complete with rail, cars, drive, motors, electrical equipment, take-up set, and installation drawings. 105 cars—30" wide and 54" long—have trays spaced every 65". Cars have reinforced concrete tops. Total over-all length of conveyor is 568 feet and 9 inches.

For complete information call or write

PAUL M. WIENER FOUNDRY COMPANY
BOX 216, MUSKEGON, MICHIGAN

FOR SALE

1—New Style 1000-GTC-M Hausfeld Gear Tilting Multiple Burner Furnace lined with high temperature silicon carbide lining, backed with insulation to accommodate a Tercod #11, 100 crucible having a capacity of 1000# of Aluminum per heat and complete with four NT-7 Tunnel Type Burners with 1¼ dia. orifice and with North American Single Valve proportioning equipment consisting of zero governor, aspirator mixer, air and gas valves, all ready to operate from 528 BTU gas and from 16 oz. air and with 20" x 5" high crucible rest block.

AMORY PERMANENT MOLD CO. INC.
366 AMORY STREET
JAMAICA PLAINS, 30, MASS.
TELEPHONE ARNOLD 1950

FOR SALE

1—405 Osborn jolt roll-over pattern draw; jolt cylinder 12" dia. Pattern draw 18" max. flask limit 64".

BOX 421
The FOUNDRY CLEVELAND 13, OHIO

FOR SALE

1—Battery of four 24" x 54" tumbling barrels.
1—30" x 52" tumbling barrel only.
1—30" x 38" tumbling barrel only.
4—18" x 52" tumbling barrel only.

BOX 420
The FOUNDRY CLEVELAND 13, OHIO

FOR SALE

1—Mahr, model No. 556-C-750,000 B.T.U. oil fired, portable mold dryer. Brand new—never used. Attractively priced for quick sale. Address: Box 315, The FOUNDRY, Cleveland 13, Ohio.

FOR SALE

One—Motive junior type sand slinger with lowering and raising arms and receiving hoppers, complete with motors, starters and push button. Purchased in September, 1943.

BUILDERS IRON FOUNDRY
P. O. BOX 1342
PROVIDENCE, R. I.
CONTACT: MR. C. I. BEARSE, P. A.

FOR SALE

Model C-2 Royer, No. 30-02, 220 volt, 3 phase, 60 cycle motor, good condition with extra sand belt.

American Foundry Equipment sand cutter, model (AA), No. 568-R, size 56", equipped with a 220 volt, 3 phase, 60 cycle motor and a stock of replacement parts.

J. E. GILSON COMPANY
369 WESTERN AVE.
PORT WASHINGTON, WIS.

FOR SALE

1—Wilbraham-Green cupola blower with 50 H.P. Motor
1—50 H.P squirrel cage motor—A.C., 3 P.H., 60 C., 220 V., 900 R.P.M.
1—Sand blast cabinet and collector
1—Norton floor grinder
1—blower 7"

GREEN BAY SOAP COMPANY
GREEN BAY, WISCONSIN

FOR SALE

Herman Pneumatic—Molding Machines

These machines are in good condition: One is still in service. Three have only recently been removed from service because of changes of methods.

40" x 50"	Jolt Roll-Over Draw ..... Rated Capacity 7600 lbs.	$1,000.00
24" x 36"	Jolt Roll-Over Draw ..... Rated Capacity 4700 lbs.	800.00
20" x 38"	Jolt Roll-Over Draw ..... Rated Capacity 2400 lbs.	800.00
40" x 72"	Plain Jolt ..... Rated Capacity 9700 lbs.	700.00

FULTON FOUNDRY & MACHINE CO., INC.
E. 75th ST. & MORGAN AVE.
CLEVELAND 4, OHIO
FOR SALE

EQUIPMENT FOR SALE

1—Osborn #93 Core Blower	$1100.00
4—Osborn Plain Squeezers	125.00 ea.
1—#276 P. J. Osborn Jolt Squeezer	500.00
1—#210 P. J. Osborn Jolt Squeezer	400.00
2—Osborn #601 Jolt Roll-overs	650.00 ea.
2—Royer Portable Sand Blending Machines 440 V., 3 phase, 60 cycle motor	200.00 ea.
4—International 20 x 8 Draw Type R-Hand Ram, Hand draw, hand roll-over machines	125.00 ea.
1—North American Turbo Blower 2000 cu. ft. m., 32 oz., 30 H.P., 3500 R.P.M., 440 V., 3 phase, 60 cycle A.C.	650.00
4—Lowe Electric Gyratory Riddles 440 V., 3 phase, 60 cycle	70.00 ea.
1—General Electric Turbo Blower 1950 cu. ft. m., 32 oz., 27½ H.P., 3500 R.P.M., 440 V., 3 phase, 60 cycle A. C.	750.00
1—Spencer Turbo Blower 1300 C.F.M., 32 oz., 25 H.P., 1750 R.P.M., 440 V., 3 phase, 60 cycle, A.C.	700.00
1—Exhaust Fan for sand or cleaning system 40 H.P., 3 phase, 60 cycle, 440 V., A.C.	525.00
1—Electrolift Hoist ¾ ton 220 V., D.C.	150.00
1—Electrolift Hoist ¼ ton 220 V., D.C.	100.00
1—Star Electric Hoist ½ ton 220 V., D.C.	125.00
1—Link Belt Portable Belt Conveyor 26 ft. long 18" belt with all weather 440 V., 3 phase, 60 cycle motor	500.00
1—Roth Brothers Motor Generator Set, D.C., 15 H.P., 230 V., 1800 R.P.M. Shunt Wound. A.C., 220-440 V., 3 phase, about 25 H.P.	650.00
1—Westinghouse Motor Generator Set, D.C., 62.5 H.P., 230 V., 1200 R.P.M., Shunt Wound. A.C., 220 V., 3 phase, about 75 H.P.	1200.00
1—U. S. Electric Tool Grinder double spindle polishing lathe 3 H.P., 440 V., 3 phase, 60 cycle	200.00
1—Westinghouse Motor 30 H.P., 220-440 V., 3 phase, 60 cycle, 3500 R.P.M.	275.00
1—U. S. Electric Tool Co., Polishing Lathe 2 H.P., 440 V., 3 phase, 60 cycle	150.00
1—Gardner Polishing Lathe 3 D. 5 H.P., 440 Volt 3 phase, 60 cycle	500.00
1—Marschke Grinder 440 V., 3 H.P., 1800 R.P.M., 3 phase, 60 cycle	200.00

MARCH-BROWNBACK CO., INC.
POTTSTOWN, PA.

FOR SALE

3—slightly used Johnson & Jennings #918-B jolt rollover pattern draw molding machines, table 44" x 54", pattern draw 20", capacity 2000 lb. at 80 lb. air pressure.
1—slightly used #34 model S. A. Davenport jolt rollover draw machine.
1—#6 Modern Equipment cupola one year old, in good shape with approximately 40' stack.

GENERAL MALLEABLE CORPORATION
WAUKESHA, WISCONSIN

FOR SALE

2—Palmer Bee worm gear reducers, size W. 6. H., Ratio 60—1.
2—Size W. 6. H., ratio 40—1. Shaft size on motor end 1⅝", on output end 2⅞".
These speed reducers are practically new and are in A-1 condition.

HAYNES FOUNDRY EQUIPMENT CO.
814 ADA ST.
KALAMAZOO 52, MICH.

MOLDING MACHINES

2—#610 Johnston & Jennings jolt rollover, pattern draw, slightly used.

New Condition

THE LIGHT ALLOYS MFG. COMPANY
PAINESVILLE, OHIO

FOR SALE

1 Marschke direct drive swing grinder 12" x 2" with 3 HP—1800 RPM—440 volt—3-60 motor and control No. 6796. This machine is like new, has been used only two weeks. Address: SIBLEY MACHINE AND FOUNDRY CORP., 206 E. TUTT ST., SOUTH BEND, INDIANA.

FOR SALE

(1) 43" x 16" draw International type F jar ramming power turnover power draw molding machine widened to accommodate a 55" outside width flask, fitted with rollers in the draw section. Cam flask equalizers and air flask clamps. Turnover capacity of this machine is 3000#. Address: Box 438, The FOUNDRY, Cleveland 13, Ohio.

Classified Advertising

For Sale

OVERHEAD CRANES

1-TON
Detroit 38' Span
Shepard Niles 12'

2-TON
Conco 12' Span
Chisholm Moore 25'
Shaw Box 17'7"

3-TON
P&H 42'1½" Span
Case 51'2" Span
P&H 37'6" Span
Niles 20' Span
Shepard 28' Span

5-TON
Alliance 95' Span
P&H 20' Span
Shepard 27'6" Span
Detroit 38'8" Span
P&H 75' Span
P&H 31'10" Span

6-TON
Northern 46' Span

7½-TON
P&H 60' Span
Hand-Operated 12' Span

10-TON
Alliance 58'9" Span
Shepard Niles 27'7½" Span
Morgan 55'6" Span
Ederer 74'4" Span
Lane 50' Span
Cleveland 51'3" Span
2 Yd. Morgan 60' Span
Northern 49'7" Span
Shepard Niles 57' Span
P&H 87'6" Span
Lane 60' Span
Shaw 80'9" Span
Toledo 77' Span
Whiting 48' Span
Shaw 67'6" Span
Morgan 38' Span

15-TON
Whiting 38' Span
Ederer 74'4" Span
New Albany 50'6" Span
Morgan 73'5½" Span
Bedford 34'6" Span

20-TON
Lane 50' Span
P&H 51'4" Span
Ederer 74'4" Span
Northwestern 60' Span
Whiting 75' Span

25-TON
Bedford 14'6" 67'8" 46'2" Spans
Leonard Burke 100' Span
Case 63' Span
New Albany 50' Span
Cyclops 74'4" Span

30-TON
Ederer 55' Span
Ederer 66'6" Span
Whiting 74'4" Span
Northern 75' Span
Ederer 40' Span
Ederer 76' Span

35-TON
Bedford 25'9½" Span
Cyclops 74'4" Span

50-TON
Morgan 50' Span

75-TON
Case 64'8¼" Span

150-TON
Whiting 30' Span

200-TON
Alliance 100' Span

Telephone us collect to discuss your requirements

ECONOMY CO., INC.
49 VANDERBILT AVENUE NEW YORK 17, N. Y.
TELEPHONE: MURRAY HILL 4-1616

TURBO BLOWERS

(4) 675 cfm @ 6 oz., Spencer, driven by 2 HP. 220/440 V., 3 ph. 60 cycle 3600 RPM

PRESSURE BLOWERS

2100 cfm @ 10 oz. Spencer with 10 HP, 3/60 3400 RPM motor
1400 cfm @ 8 oz., Robinson with 5 HP, 3ph, 60 cy. 3600 RPM motor
1100 cfm @ 16 oz. Sturtevant 8 x 8, 24" dia. wheel
800 cfm @ 24 oz. Amer. Blower with 10 HP, 220/440 volt, 3 ph. 60 cy. 3600 RPM
500 cfm @ 14½ oz. McKee 6 x 6 with 5 HP, 3600 RPM
250 cfm @ 12 oz. North American with 2 HP, 3/60 3450 RPM motor

THE MOTOR REPAIR & MFG. CO.
1552 HAMILTON AVENUE
CLEVELAND 14, OHIO

FOR SALE—LIQUIDATION:

1 Used Lindberg Cyclone Box type Heat Treat Furnace, complete with controls.
1 16" Sarnac Radial Cut-Off Machine 5 H.P. 440 V. Motor.
1 1000# Cap Hand tilt Fisher Furnace with 3½ H.P. 220-440 V. Blower. New—as received from factory.

Above items for quick sale and at bargain price.

PERMA-BRITE STAINLESS ALUMINUM INC.,
c/o
THE CONNEAUT BANKING & TRUST CO.,
CONNEAUT, O.

BARGAIN FOR QUICK SALE

1—Ransohoff Water Mill 36 x 60 side loading and end loading. Automatic star separation and star return. Complete with direct drive and in good condition.

BOX 419
THE FOUNDRY CLEVELAND 13, OHIO

USED EQUIPMENT FOR SALE

9 x 9 horizontal motor driven Chicago Pneumatic air compressor.
Two ton electric hoists, Yale and Towne and Speedmaster.
Chain Hoist, Yale & Towne.
Fisher gas fired tilting melting furnaces.
Lindberg electric convection 1200 deg. F. furnaces.
30 in. Bullard vertical boring mill.

STANDARD METAL AND MACHINE COMPANY
615 W. SHIPP ST.
LOUISVILLE, KENTUCKY
TELEPHONE: MAGNOLIA 1635

FOR SALE

Foundry type tumbler in good condition. Size 4' dia. 6' long, 75 cu. ft. volume barrel. No reasonable offer refused. Address: Box 475, The FOUNDRY, Cleveland 13, Ohio.

FOR SALE

6—Int. Type R.J. power jolt hand R.O. & foot draw Flasks—14" wide—8" draw
4—Int. Type R.J. power jolt hand R.O. & foot draw Flasks—20" wide—8" draw
1—Tabor Hand Rollover—20" x 8"
10—International, Type E.M.C., Special—20 x 62 x 5"
8—International, Type E.M.C., Special—14 x 30 x 5"

Core Grinder
1—Milwaukee Type #70—Price $1,750.00 ea.

1—Demmler #3 Core Blower, practically new—$850.00

1—Royer, N.D.P. Sand Separator—2 H.P., 3/60/220 Motor
1—New Belt for N.D.P. Machine

Registered as an Approved Dealer by War Assets Administration. Send us your inquiries.

SCULLY MACHINERY & EQUIPMENT CO. NOT INC.
767 MILWAUKEE AVE.
CHICAGO 22, ILL. PHONE: MONROE 8918

FOR SALE

Stroman #400 NP tilting type oil fired brass furnace, complete with blower and 4 crucibles. This machine is practically new.

ALSO

Stroman RB stationary type, 150 lb. capacity, oil fired, complete with blower.

TURNER MANUFACTURING CO.
STATESVILLE, N. C.

FOUNDRY FLASKS FOR SALE

220 sets cast steel flasks 24" x 27" with 8½" cope and 10" drag. Very good condition and reasonably priced.

RIVERSIDE FOUNDRY
BETTENDORF, IOWA

OSBORN JOLT SQUEEZERS
IMMEDIATE SHIPMENT

We have four (4) No. 275J Osborn jolt squeezers for sale. These are all in good condition and can be shipped immediately. For further information write:

BOX 436
THE FOUNDRY CLEVELAND 13, OHIO

ALUMINUM GAS FIRED FURNACE

No. 1400-IM Hausfeld stationary crucible aluminum Furnace, gas fired with silicon carbide lining, single valve control, sealed top. Furnace has never been used. Address: Box 387, The FOUNDRY, Cleveland 13, Ohio.

EQUIPMENT FOR SALE

MOLDING MACHINES
3—75J Osborn Portable Jolt Squeeze, Strain Rod Type.
1—#274 Osborn Plain Squeeze.
1—International Portable Hand Jolt, Hand Rollover, Foot Draw, Core Machine.
2—Tabor Plain Squeeze, Strain Rod Type.
3—Mumford 3" Cyl. Core Jolt, with 20" x 15" Table.

BLOWERS FOR CUPOLAS AND FURNACES
6—#805 General Blowers, 5 H.P., 3/60/220, 1400 C.F.M. at 8-oz. pressure.
1—North American 10 H.P., 3/60/220-440, 1300 C.F.M. at 16-oz. pressure.
1—North American 7½ H.P., 3/60/220-440, 1050 C.F.M. at 16-oz. pressure.
Maxon-Premix Blowers for Gas, ⅛ to 1 H.P.

METAL MELTING EQUIPMENT
2—#600 Hausfeld Single Burner Tilting Crucible Furnaces, Oil Fired. #150 to #175 Crucible Size.
1—#675 Hausfeld Single Burner Tilting Crucible Furnace, Oil Fired. #250 to #275 Crucible Size.
2—Hausfeld 1000# Aluminum Capacity Furnaces, Barrel Type, Open Flame, Oil Fired.
2—Hausfeld 2000# Aluminum Capacity Furnaces, Barrel Type, Open Flame, Oil Fired.
1—Aluminum Electric Heat Treating Unit, 75 KW, 220 Volt, Batch Type, with Basket and Quench Tank.
2—Hausfeld Open Flame Tilting Brass Furnaces, 400# capacity, Gas or Oil.
4—Stationary Gas Fired #60 Crucible Furnaces, with ¼ H.P. Maxon-Premix Blowers.
2—Monarch-Rockwell Rotating, 500# Brass. Oil.
New 32" to 41" Dia. Shell Cupolas made to order.

TUMBLING MILLS AND SAND BLAST
2—(New) Baird No. 3-D Oblique Tumbling Mills, 27" Dia. 30" deep, direct motor drive, with motor driven tilting mechanism. Load capacity approx. 400 lbs.
4—New Haven 36" x 46" Self Contained Sand Blast Barrels, Belt Drive.
2—Pangborn Syphon Feed Sand Blast Cabinets.
3—Portable Sand Blast Generator Tanks, 500# Sand Cap.

MISCELLANEOUS
1—#12 Roto-Clone Dust Collecting Unit, complete with 10 HP Motor.
1—#20 Roto-Clone Dust Collecting Unit, complete with 40 HP Motor.
4—Shake-outs, approx. 4' x 6'.
1—¾ Yd. Electric Grab Bucket for overhead Crane use.
1—Heavy Duty Back Geared Sprue Cutter, 1½" square knives, T & L pulley drive.
1—No. 1 Blystone Sand Mixer, 7 cu. ft., 5 H.P. 3/60/220-440, motor connected.
1—Shuster Wire Straightener and Cut-Off Machine. Belt Drive.
1—Wadsworth Core Machine.
2—2000# Cap. Worm Geared Ladles, V-Bail.
1—2500# Cap. Worm Geared Ladle, V-Bail.
1—4000# Cap. Worm Geared Ladle, V-Bail.
1—Cloth Screen Dust Collector.
6—Worm Geared Tilting Ingot Mold Stands, 6' to 12' long.
1—Small Motor Driven Tumbling Mill.
1—Curtis Twin-Cylinder 15 H.P. 3/60/220 Air Compressor, with radiator and fan for self-cooling
1—Core Oven 7' x 6' x 7' re-circulating hot air, truck rack type.
1—Gas Fired Hill & Griffith Semi-Circular Core Oven.
7—Hydro-Whirl, Wet Type, Dust Collecting Booths, suitable for Magnesium, Aluminum, Brass, etc. 5' x 3' working table and collecting system built as complete unit.
2—Hydro-Whirl, Wet Type, Collectors for double end grinders.

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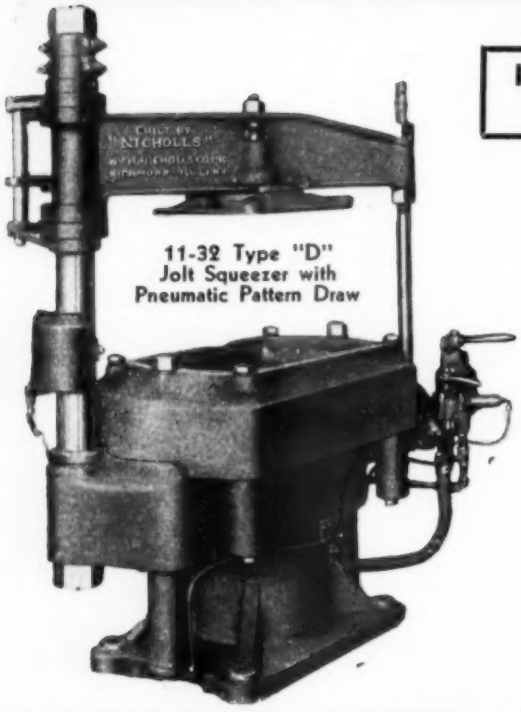
New heavy duty motorized rod cutter, 65 cuts per minute; capacity: ¾ inch round hot rolled steel. Brand new. $890.00 f.o.b. Cleveland. Address: The Federal Foundry Supply Co., 4600 East 71st St., Cleveland 5, Ohio.

FOR SALE

1 Used Wickes $420 heavy duty sprue cutter, 1¼" stroke with 5 H.P.—440 v.—3 Phase—60 cycle motor. Address: Box 447, The FOUNDRY, Cleveland 13, Ohio.



IMPROVED HEAVY DUTY MOLDING MACHINES

NICHOLLS Molding Machines are packed with POWER. They have the strength and ruggedness to withstand the pressure of continuous operation and consistently turn out the maximum number of good molds. Nicholls Molding Machines have the POWER to knock your production costs "for a loop" and give you the best possible results at the lowest possible costs. Nicholls has a complete line of stationary and portable types for the production of light, medium and heavy castings. Can be furnished with electric controls for push button operation.

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RICHMOND HILL 18, LONG ISLAND, NEW YORK

ESTABLISHED 1910

Foreign Manufacturers and Selling Agents—For Continental Europe and Great Britain—The George Fischer Steel and Iron Works, Schaffhausen, Switzerland

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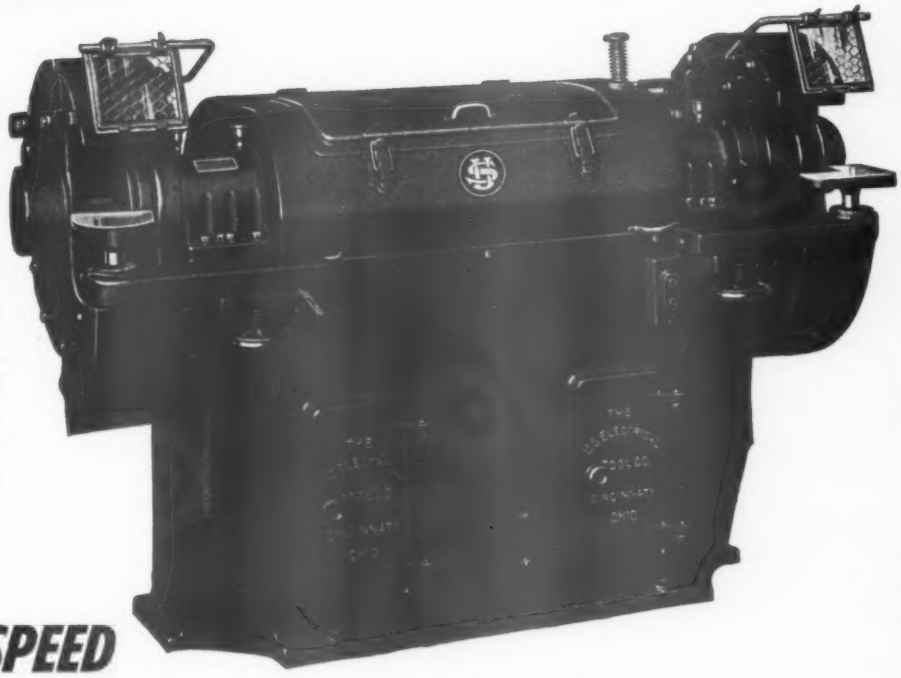
THE UNITED STATES ELECTRICAL TOOL CO.
OUR 50th YEAR
CINCINNATI, OHIO

UNITED STATES ELECTRICAL TOOLS COMPETE IN PRICE and EXCEL IN PERFORMANCE

WHETHER you install just one US tool or set up a battery — as many industrial plants often do — they fit into your production line just as perfectly as if designed by your own plant layout engineers.

UNITED STATES ELECTRICAL TOOLS are superb examples of the tool-makers' craft . . . still faithful to those old-fashioned ideals which started off this organization in 1897 — fifty years ago. Design, engineering and construction have been kept flexible to conform to present and advance requirements . . . but quality is undeviating all ways.



ADJUSTABLE SPEED SNAGGING GRINDER . . . Model 66

This grinder meets the demand for an efficient belt-driven grinder, free from vibration. Changes in speed to compensate for wheel wear are easily and speedily accomplished by elevating the motor on its hinged tray. Belts are transferred to the next smaller pulley by a hand wheel nut and correct belt tension can be maintained at all times by adjusting the motor height. A patented safety device prevents wheel over-speeding. WHEEL GUARDS ARE ADJUSTABLE. SHAFT is one-piece chrome-manganese steel supported by four heavy-duty ball bearings enclosed in dustproof housings, protected by labyrinth seals. MOTOR is built to N.E.M.A. standards. Push button control and overload protection.

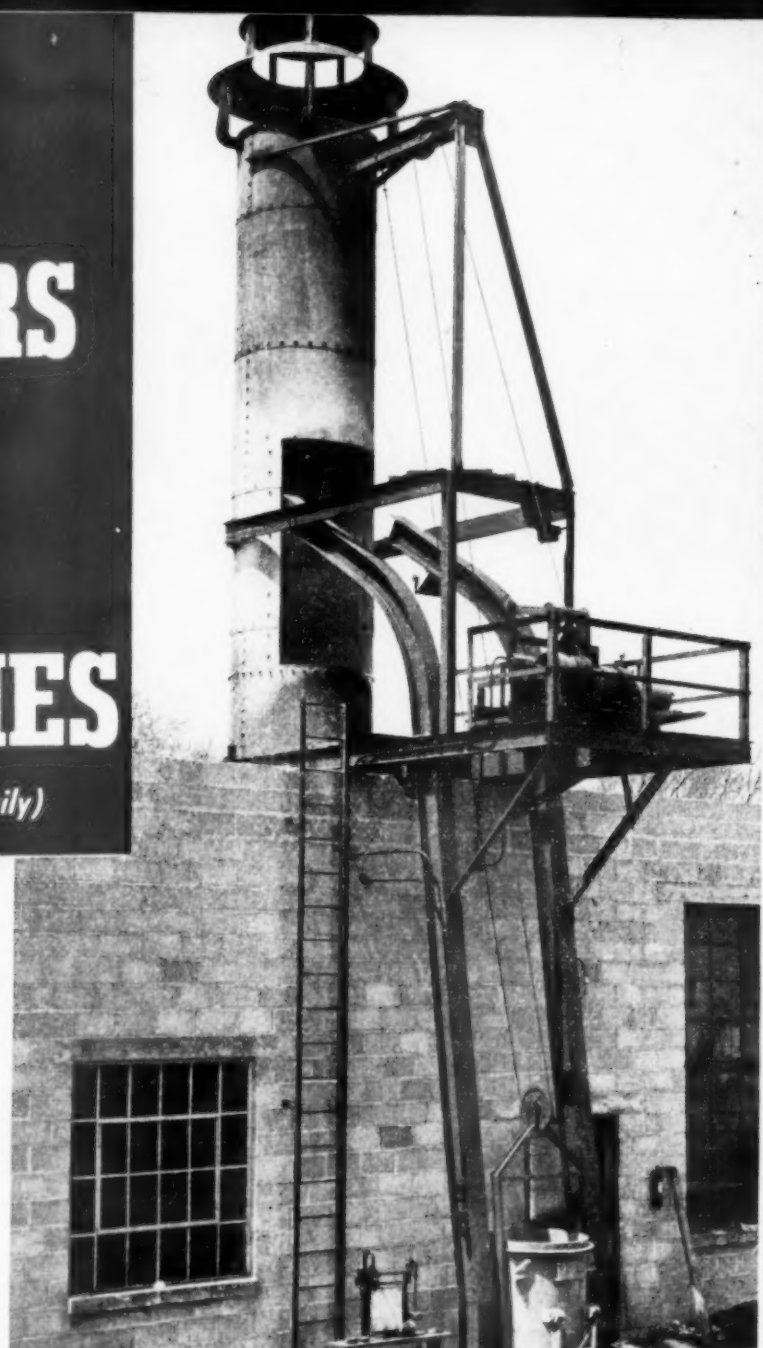
CONTACT YOUR DISTRIBUTOR FOR DETAILS AND PRICES

Drills, grinders, surfacers, polishers, sanders, tappers, saws, hole saws, valve seat grinders, valve refinishing shops, flexible shaft machines and other electrical tools.

The UNITED STATES ELECTRICAL TOOL Co.
CINCINNATI, OHIO

NOW! CUPOLA CHARGERS for SMALL FOUNDRIES

(Melting up to 12 tons daily)



Here is a MODERN charger designed for the small foundry. It comes completely equipped, including the single, drop-leaf bucket which gives even charge distribution. Operation is fast and smooth. Its moderate cost and easy installation puts it within the reach of any foundry melting up to 12 tons daily. The unit shown here was actually installed over a week-end!

PLAN WITH "MODERN" FOR LATEST DEVELOPMENTS IN CHARGING

We invite you to consult with us on your charging problems. Modern pioneered in the development of mechanical charging and offers foundrymen ALL of its experience and "know-how."

CUPOLA CHARGER CATALOG 143-A (24-pages) IS NOW AVAILABLE

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& Equipment Ltd.
Montreal Toro

Stevens Core Paste

e can truthfully say that if a Core Paste isn't good, it isn't a Stevens Core ste. Our sales records of past years prove that foundrymen everywhere give tinued approval of Stevens Core Pastes.

tevens Core Pastes are of unusually high quality, because they have the following eatures:

1. They have high green and dry strengths. When one half of a core is pasted and the two halves are pressed together, the paste grabs the other half immediately, allowing the core to be safely handled to the drying rack and to the oven.
2. They develop maximum strength rapidly.
3. They will not swell or boil when oven dried.
4. They mix easily with water to a smooth, easy-to-work consistency.
5. They do not cake in the barrel.
6. They may be applied with a paste bulb, a float jig, a pasting roller, or by any other method.
7. They are uniformly compounded so that standard mixes may be established.
8. They do not lump during mixing.

We offer the following grades of Core Paste, which provide a type for any specific requirement.

Stevens No. 3 Core Paste

A particularly fast-drying paste, with excellent green strength and high dry strength. Can be air dried in a few hours, thus saving oven space for baking cores. Grey in color, it becomes black when mixed with water. It can be used for pasting all types and sizes of cores used in the casting of all metals. No. 3 Core Paste can also be used as a core binder in conjunction with core oil. Packed in barrels, about 350 pounds net weight.

Stevens High-Temperature Core Paste

A refractory base core paste that will stand up no matter how hot the metal. Ideal for pasting cores for steel castings. An excellent product for automotive cores.

Stevens No. 7 Core Paste

A low cost core paste for all general pasting requirements. Joints have tensile strength of 200 lbs., either air or oven dried. For use where oven temperatures do not exceed 400° F.

When a pail of No. 7 Core Paste is allowed to stand unused for several hours, only a slight skin is formed on the surface. A few turns with a stick and the film is entirely dissolved.

No. 7 Core Paste is not recommended for use as a core binder. However, its low price makes it very attractive as a pasting material. Packed in barrels, about 370 pounds net weight.

Stevens Regular Core Paste

An economical, all-purpose core paste of the type preferred by many foundrymen for years. Red in color, easy to see, this paste is not quite as strong as other grades, but good for small cores or for cores that do not undergo excessive strains in handling or in the mold. Should be dried at temperatures below 400° F. Packed in barrels, about 300 pounds net weight.

Stevens No. 4 Core Paste

Developed for use where gas-forming materials must be kept to an absolute minimum. No. 4 Core Paste is not quite as strong as the other grades, but is good insurance against gas "blows." Has high collapsibility and will not form a paste bridge when used for thin cores. Packed in barrels, about 450 pounds net weight.

FREDERIC B. STEVENS, INC.
FOUNDRY FACING MATERIALS
THIS BARREL CONTAINS STEVENS CORE PASTE
DETROIT, MICH.

The Best You Can Buy

"Everything for a Foundry"

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- 2368 Dundas St., West . . . . . Toronto, Ontario

A CONTRAST in Foundry Practice

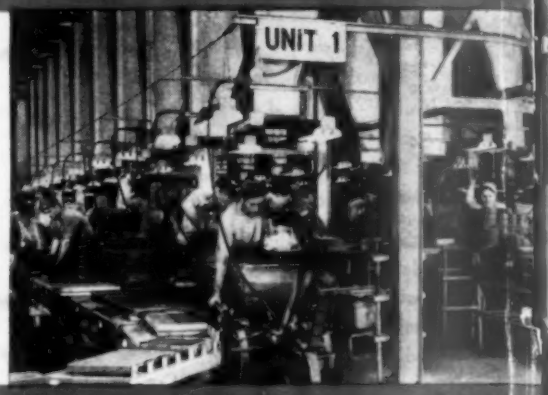
Before and After LINK-BELT Mechanization at Oliver Corp.

←BEFORE

Back-breaking drudgery. Inefficient hand shoveling of sand into molds and carrying out of molds on to foundry floor.

AFTER→

Link-Belt Mechanization. Properly prepared sand is delivered to hoppers above molding machines, gravity fed to molds. Finished molds placed on conveyor—no carry out required.

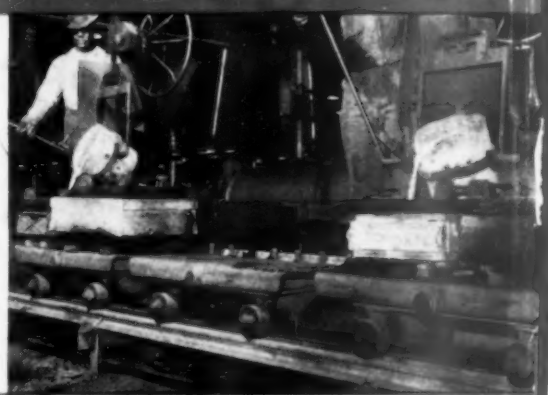


←BEFORE

Hand pouring. Back-breaking and dangerous. Production suffered because each molder limits production to the number of ladles of iron he wishes to pour.

AFTER→

Link-Belt Mechanization. Molds move along pouring zone. Pouring conveyor moves at same speed as mold conveyor. Pouring is faster, easier and more efficient.



←BEFORE

Smoke and gas from poured molds and confusion of hand pouring adds to difficulty in securing foundry help and reduces their effective years of service.

AFTER→

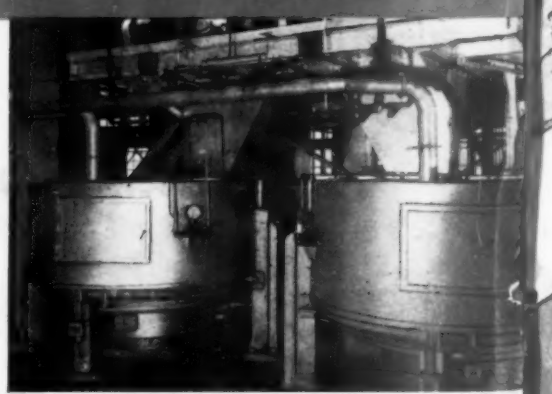
Link-Belt Mechanization. Poured molds conveyed through ventilated cooling hood and automatically discharged on to shakeout screen, eliminating one of the dirtiest and hardest jobs in a foundry.

←BEFORE

The dirty, messy job of wetting and cutting sand results in poorly prepared non-uniform sand heap.

AFTER→

Link-Belt Mechanization. Showing mullers and automatic sand preparation unit for uniform and proper preparation of sand, after molds have been automatically dumped and conveyed to preparation unit.



LINK-BELT COMPANY

Chicago 9, Indianapolis 6, Philadelphia 40, Atlanta, Dallas 1, Minneapolis 5, San Francisco 24, Los Angeles 33, Seattle 4, Toronto 8. Offices in Principal Cities.

10,748

THE SYMBOL OF QUALITY — LB — LINK-BELT

MANUFACTURER'S FOUNDRY EQUIPMENT ASSOCIATION, INC.

LINK-BELT CONVEYORS

AND PREPARATION MACHINERY